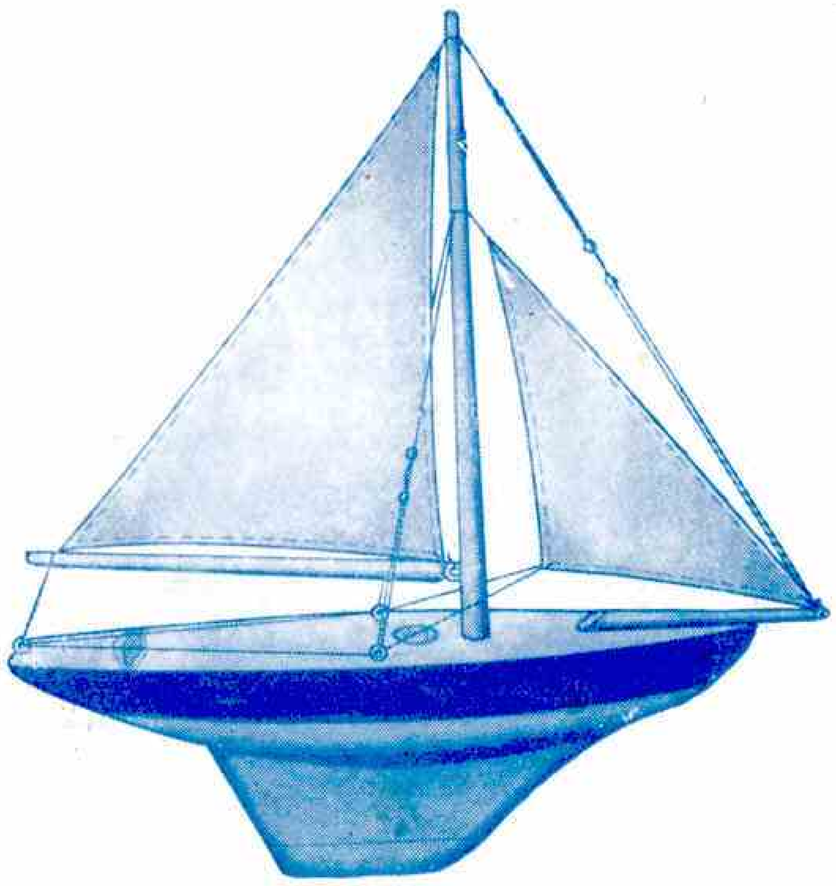
VOL XIV Nº5 MAY 1929

MECCANO MAGAZINE

A HUGE CRANKSHAFT (See page 354)

6D

Put a thrill into sailing!



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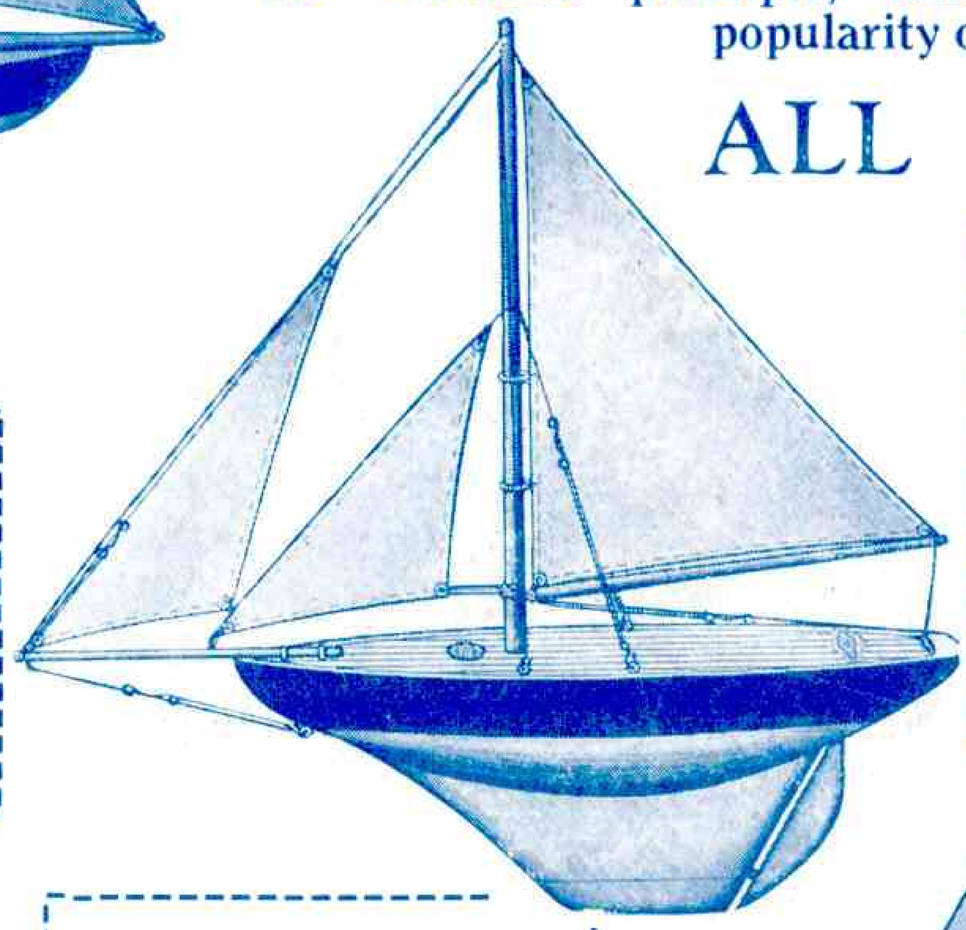

The "ACE"

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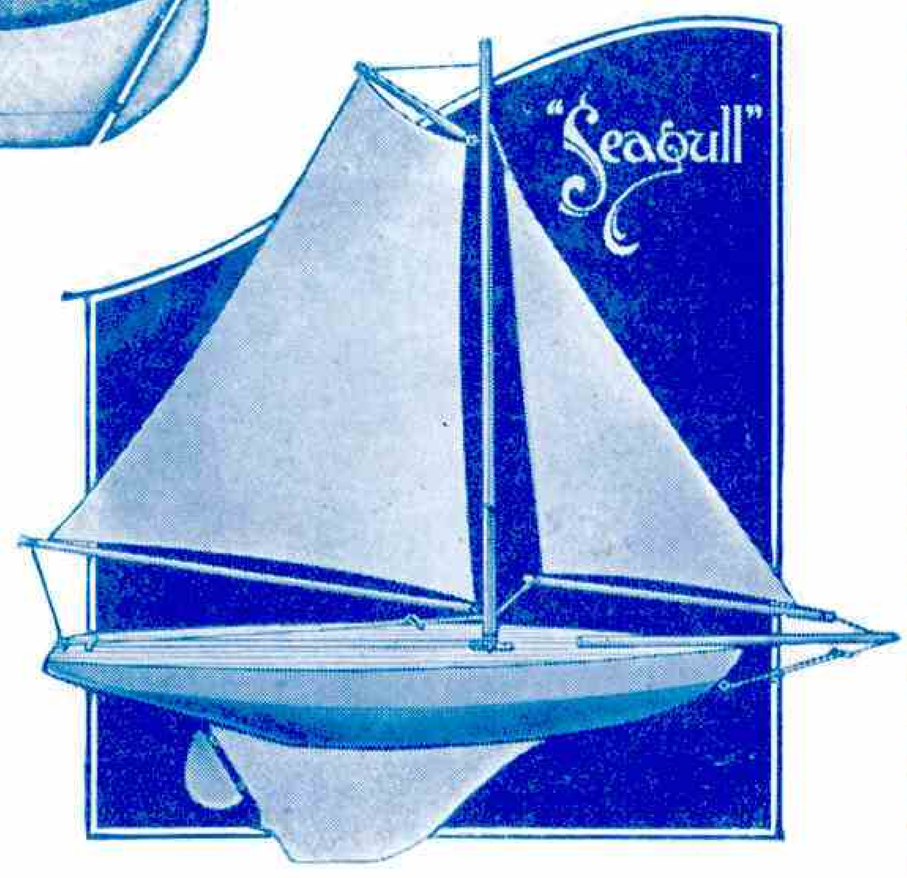

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With the Editor

The Real Originators of Inventions

Inventors usually may be described as the men who apply principles and laws discovered by scientists, the latter in many cases being quite indifferent to the practical or financial value of their work. This division between the scientist or investigator on the one hand, and the inventor on the other, often has made it difficult to decide who have been the real originators of inventions, and in awarding the credit for the development of many of these it is easy to be a little unfair. For instance, in thinking of wireless, the name that instantly springs to mind is that of Marconi. No one would dream of depreciating the wonderful work that he has done, but while giving him every credit we should not forget Heinrich Hertz, Sir Oliver Lodge, and the numerous other scientific pioneers whose researches prepared the way for him.

Another result of this division has been that occasionally two men, working quite independently, have produced almost identical inventions at the same time. Perhaps the most striking example of this occurred in the case of the telephone, Graham Bell and Elisha Gray applying for patents for this invention within a few hours of each other! Both men had hit upon the same practical application of certain electrical principles, and neither had the slightest idea that the other was working on the problem or of each other's existence.

Even when one man is definitely responsible for an important invention, it is frequently the case that so many improvements are introduced by later inventors that the original idea is almost forgotten. In other instances inventors have been compelled by adverse circumstances to abandon work that afterwards has been carried to a successful conclusion by a rival.

The career of Dr. Karl Benz, the famous German motor engineer, whose death occurred recently, provides excellent illustrations of all these points. Many years before any vehicle resembling a modern motor car was seen upon the highway, the theory of the internal combustion engine—its most important component—had been fully worked out by various engineers, one of whom, as early as 1862, had suggested and explained the cycle used in the four-stroke engine. The problem that exercised the ingenuity of inventors was how to apply this engine to the practical work of driving a wheeled carriage. Many men contributed to its solution, and the original invention has been claimed as the work of three—an American named Selden, Siegfried Markus, who lived in Vienna, and Karl Benz.

Who "Invented" the Motor Car?

The claims of Selden are now disregarded, for he does not appear to have advanced his designs as far as the stage of running a car on the roads. The remaining claimants acted quite independently and each was successful. As far as can now be ascertained, the honour of having been the first to propel a carriage by means of a petrol engine belongs to Markus. Unfortunately for his reputation, Markus was compelled by the police of Vienna to discontinue the use of his vehicle, as the crowds of curious people attracted by it impeded other traffic!

The opposition met with by the Austrian inventor left the way clear for his German rival. From the beginning of his career Benz was determined to make a road vehicle that would move under its own power, and as early as 1877 he fitted a gas engine to an old "bone-shaker" bicycle. This was not too successful, and his friends and associates came to regard him as a clever engineer who at the same time was a bit of a crank. This was shown in an amusing manner when the Benz Company was formed to manufacture gas engines, for it was agreed that any money the inventor might spend on the construction of motor vehicles should be considered as a dead loss!

It was not until 1885 that Benz built his first real motor car. This was a three-wheeled vehicle, driven by a petrol motor rated at 0.75 h.p., and it travelled at the remarkable speed of 12 miles per hour. It may be regarded as the real forerunner of the modern motor car, and it is interesting to learn that coil and battery ignition was used, for this method recently has shown signs of being generally adopted once more after having been almost entirely displaced for a considerable time by the magneto.

At first nobody would buy his motor cars, but Benz persisted in the face of great difficulties. He continued to experiment, and his perseverance eventually was rewarded when a French dealer bought his entire output of 30 cars.

Although the modern motor car embodies a very large number of inventions, Karl Benz made the greatest contribution to its development, and on that account may fairly be regarded as its inventor in the usual sense of the word. Only two days before he died, a great rally of motor cyclists was held in Mannheim, where the huge Benz motor works are situated, to pay tribute to the founder of the world's motor industry. Unfortunately Benz was too ill to take any part in the rally arranged in his honour, and he died on 3rd April, at the age of 84.

WHAT EVER IS IT?

No. 6. Here is the sixth puzzle in the series of mystery photographs that readers are asked to identify. If you think you know what this mysterious looking object represents, write your answer on a postcard, address it to Editorial Competition, No. 6, Meccano Limited, Old Swan, Liverpool, and post it before the 31st May.

To the first reader to send an exact answer, or to the reader who gets nearest, I will send an autographed copy of my book "Engineering for Boys."

April Mystery Photo

Opinions as to the identity of the fifth "curio" differed extraordinarily, and less than 10 per cent. of the entrants hit the nail on the head with "a pestle."

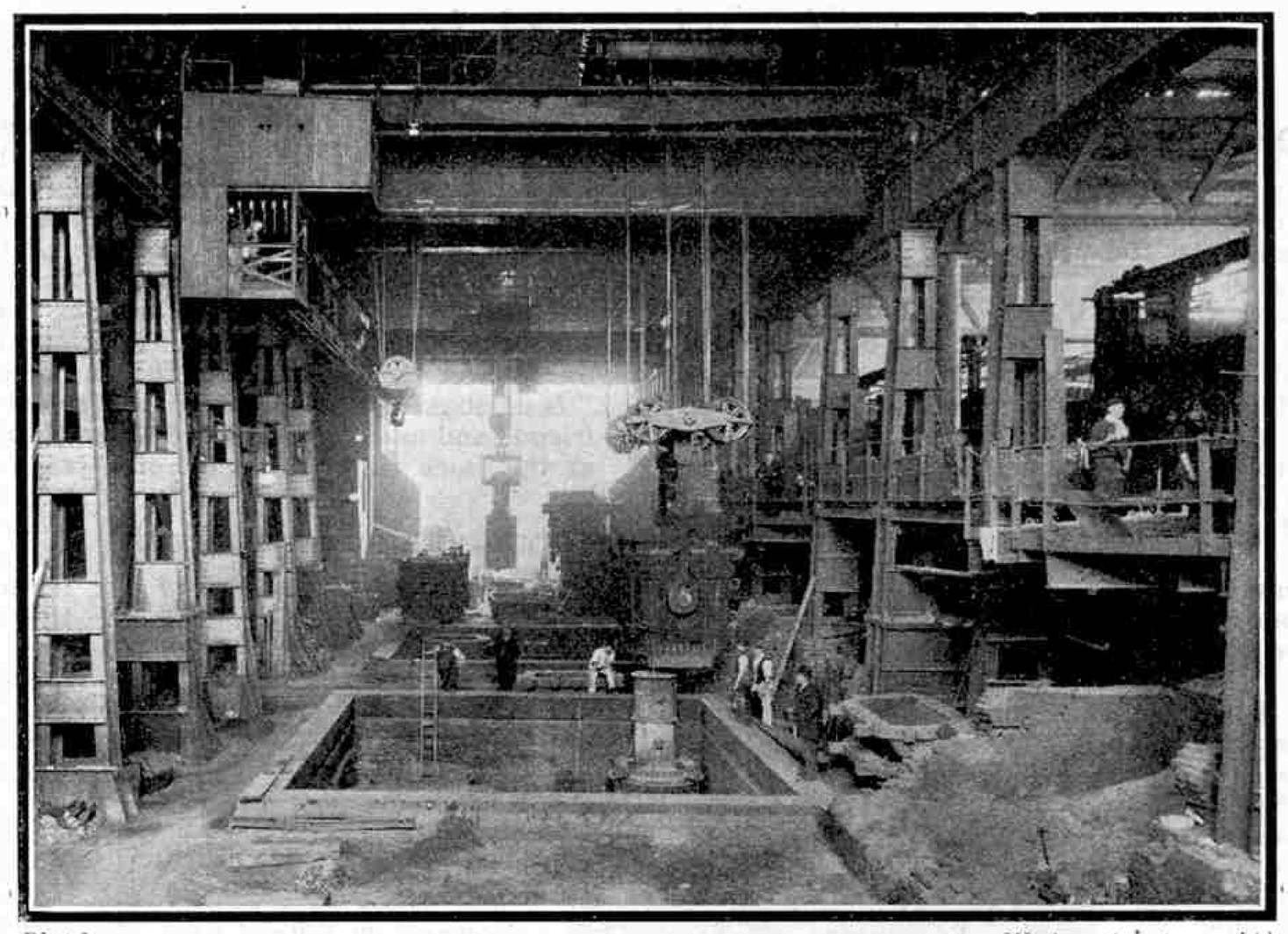
The first correct solution examined was from F. R. P. Vinter, Archbishop Holgate's Grammar School, York, to whom an autographed copy of my book *"Engineering for Boys"* has been sent.

Among the unsuccessful competitors, we feel that pride of place ought to go to the boy who decided that the picture was of the mouth of a cannon with the ball coming out. Nearly as ingenious was "a tiddley wink viewed from above!"

Forging Fifty-Ton Crankshafts

A Triumph of Engineering Skill

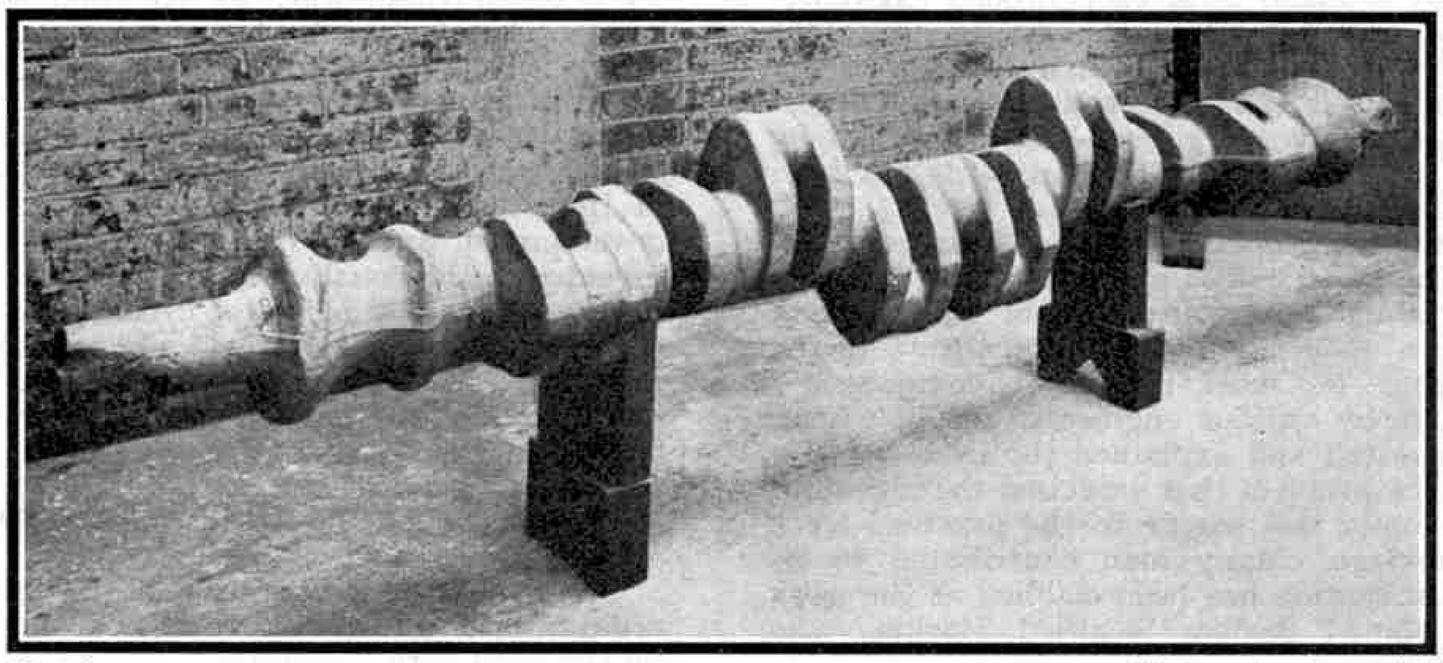
ON our cover page this month we illustrate a huge crankshaft that was made recently for a high-power marine engine. The manufacture of these great shafts entails a number of extremely interesting processes, and in this and a second article we propose to describe simply how these shafts are forged, machined and fitted. Some idea of the wonderful accuracy of the various machining processes may be gained from the fact that the length and the diameter of the shaft shown on our cover is measured to a fraction of a millimetre!



Photo] [*Vickers-Armstrongs Ltd.*

Open Hearth Melting House Casting Pits showing a 120-ton crane carrying a ladle with 80 tons of molten steel that is to be poured into one of the huge moulds

Crankshafts in one form or another are required in all reciprocating engines for the purpose of converting the up-and-down or reciprocatory motion of the piston into rotary motion, in order that the power generated by the engine may be applied in the most practical and efficient manner. With the advent of monster ocean liners driven by compound reciprocating engines of enormous horse power, crankshafts of gigantic proportions have become necessary, and to follow the various processes in the making of such shafts from the stage when the rough ingot leaves the furnace until the finished shaft emerges from the machine shop affords a splendid instance of the high standard of skill and accuracy demanded in modern engineering.



Photo] [*Vickers-Armstrongs Ltd.*

A fine example of an Aeroplane Crankshaft that was produced by the Drop-Forge Stamping method

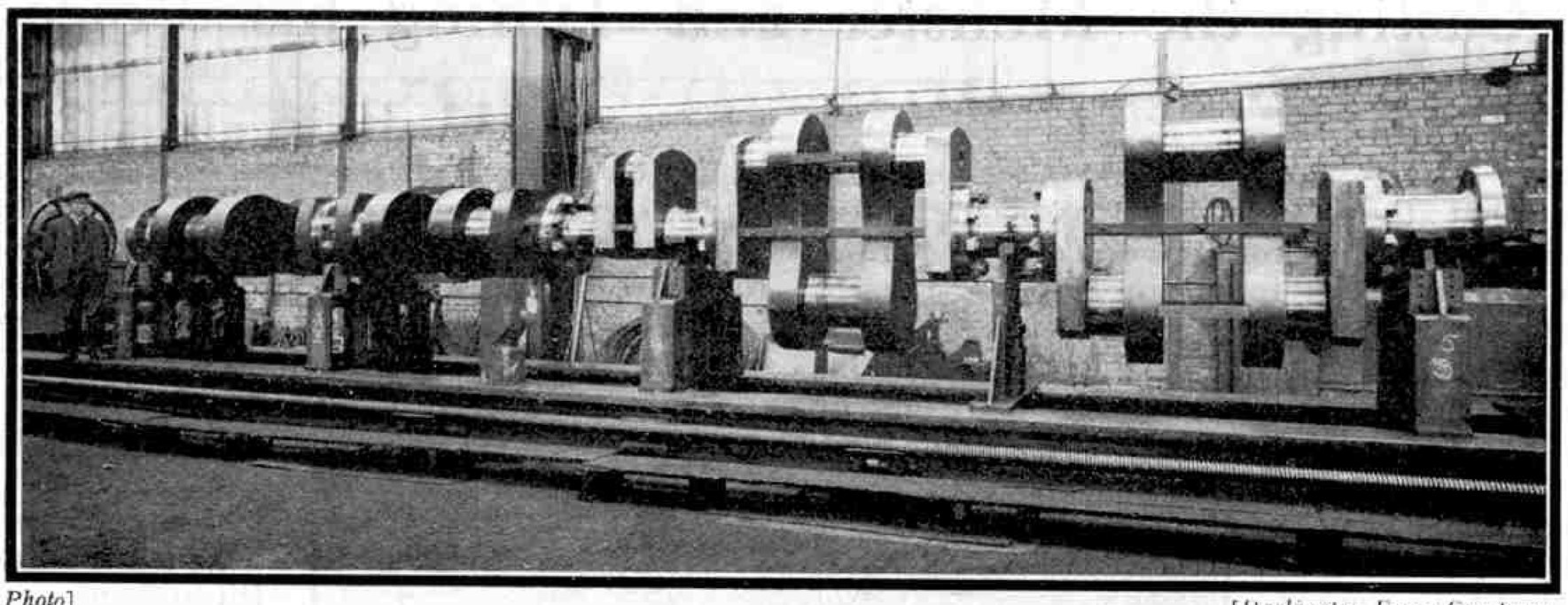
Some of the largest modern crankshafts require an ingot of steel weighing as much as 70 tons, and this is usually produced in Siemens Open Hearth furnaces. In the Siemens furnace hot gas produced by burning coal with a limited supply of air is passed through a chamber of chequered brickwork called the regenerator chamber. This chamber is previously heated, and in passing through it the hot gas is further increased in temperature. Air is passed through a similar chamber and raised to a very high temperature, and the hot air and the hot gas are brought together in the furnace where combustion takes place at once.

The gases resulting from this combustion are drawn out of the furnace at a very high temperature and passed through chambers exactly similar to those through which the air and gas passed previously. The combustion gases part with their heat to the brickwork, and then by means of valves the whole process is reversed—the air and the unburnt gas passing through the chambers heated by the gases produced by combustion, and the latter gases passing through the chambers that have become cooled by giving up their heat in the first place to the air and active gas. This reversal is continued at regular intervals and results in a gradual increase in the furnace temperature up to the point required.

The open hearth process may be either acid or basic. In the acid process the furnace is constructed of silica bricks and the bottom, made of sand burnt-in in layers, is formed to the shape of a saucer with a slope toward the tap hole at the back. Pig iron is placed at the bottom of the furnace and scrap iron is then added.

When the mixture is melted a sample is withdrawn to test the amount of carbon, any excess of which is oxidized by adding ore. By this time the silicon is eliminated, and when the proportion of carbon is correct, the metal and slag are drawn off into a ladle.

In the basic open hearth process magnesite bricks are used for all parts of the furnace that come in contact with the metal. Ore and limestone are put in a dish of molten pig iron from the "mixer," a kind of storage vessel for the metal coming from the blast furnaces. After a few hours the iron and the limestone melt and samples of the metal are drawn off at intervals and analysed. Ore and other metals are added until the quality of the metal is correct, and when the temperature also is correct the furnace is tapped and the molten steel run off into a ladle. Ferro-manganese is added to the steel while it is running into the ladle to give the proper amount of manganese and silicon, and to assist in the formation of sound ingots.



Photo] [*Darlington Forge Company*

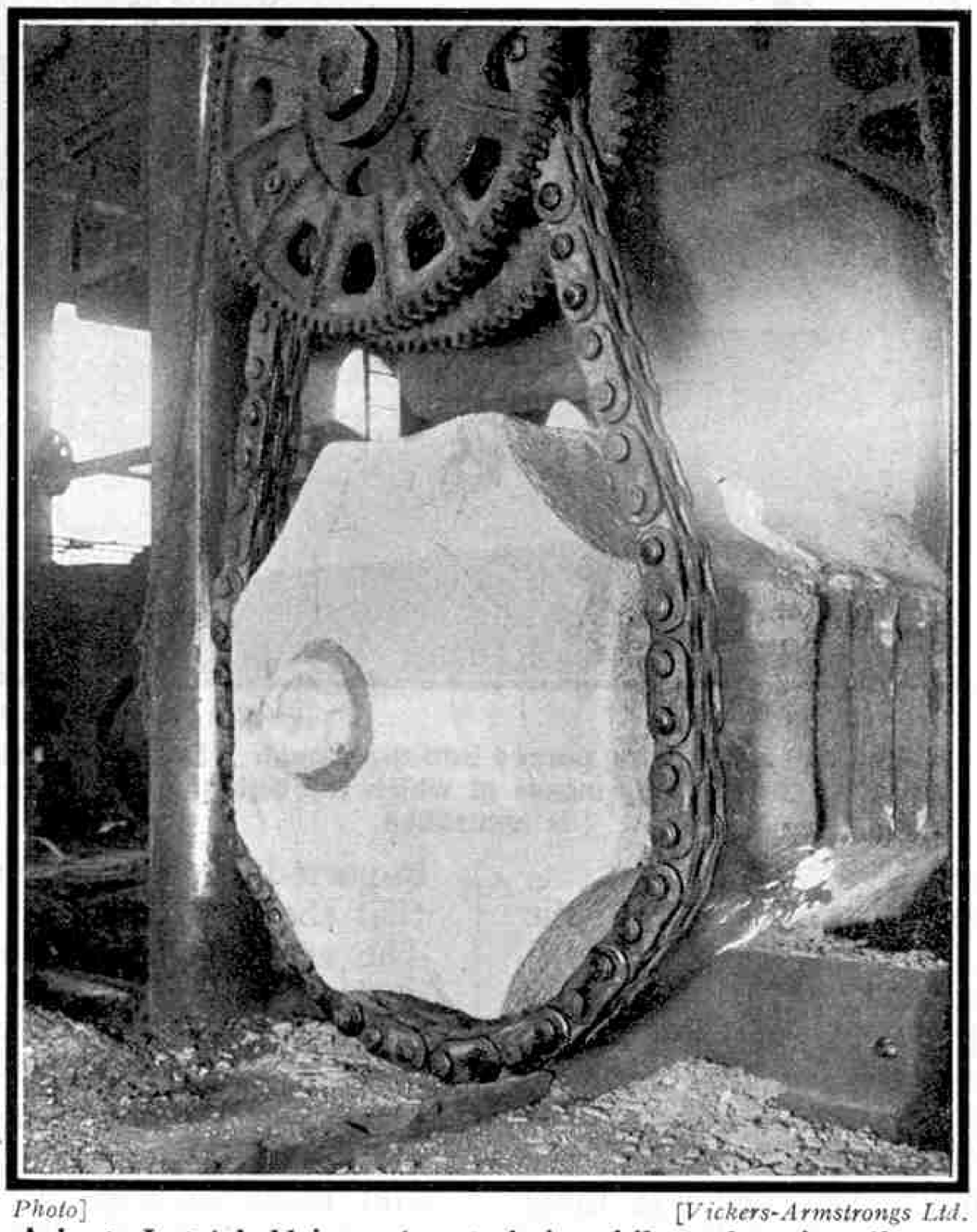
A large built-up type Crankshaft made recently for a Diesel engine. The enormous length of this shaft may be gauged by comparison with the figure of the man

The ingots required for the large modern crankshafts are usually produced in open hearth acid furnaces. When the molten metal is ready it is run into ingot moulds, and while these moulds are being filled pieces of aluminium are thrown in with the object of preventing the production of "blow holes" caused by gases dissolved in the metal separating out as the metal cools and solidifies. After about half an hour the moulds are stripped off, and the ingots are placed in soaking pits or charged into a re-heating furnace.

A soaking pit consists of a chamber lined with firebrick, large enough to hold an ingot easily and fitted with a lid. The object of the soaking pit is to bring the ingot to a uniform temperature throughout; if this were not done the ingot would be hard outside and soft inside. In the soaking pit an ingot gives off heat to the firebrick until the chamber and the ingot are at the same temperature. The ingot then cools down so slowly as to avoid any risk of internal rupture due to shrinkage stresses.

The re-heating furnace serves practically the same purpose as the soaking pit, and a complete forging operation may necessitate any number of re-heatings from one to eight or nine.

When the ingot has thus been prepared it is taken to a hydraulic forging press, and one of the accompanying illustrations shows the operation of forging being carried out.



Photo] [*Vickers-Armstrongs Ltd.*

A huge Ingot held in a strong chain while undergoing the re-heating process. The complete forging operation sometimes necessitates several re-heatings

When made in one piece as a solid forging the crank heads and pins are forged as a solid slab from which they are subsequently formed by machining. Two holes are drilled through the slab from side to side, the holes being spaced apart roughly the length of the crank pins. Saw cuts are now made up to these holes and a slab of steel is thus removed, which is put to valuable use for making tensile and bending tests, and in this manner ascertaining the quality and structure of the metal.

The forged ingot is now ready for the annealing furnace, where it is annealed before going to the machine shop for the first rough machining. In the case of exceptionally large shafts the annealing process may be repeated a second time. This process greatly improves the structure of the metal.

Many of the smaller types of crankshafts such as those used in motor car and aeroplane engines are usually made as drop-stampings. The largest shafts ever produced in this way have been made at the Vickers-Armstrong Works at Sheffield, each forging weighing $16\frac{3}{4}$ cwt. In this drop-stamping method the shaft is made from a straight bar that is forged and then bent so that, when finally drop-forged to shape, the "grain" of the steel, instead of running straight across the webs, runs always in the direction that will give the maximum strength of resistance to failure by fatigue. The production of perfect drop-forgings of this nature is highly skilled work and long experience is required in order to ensure complete success.

(*To be continued*)

HOW THINGS ARE MADE

The Life-Story of a Great Bell

Casting the Monster and Tuning his Voice

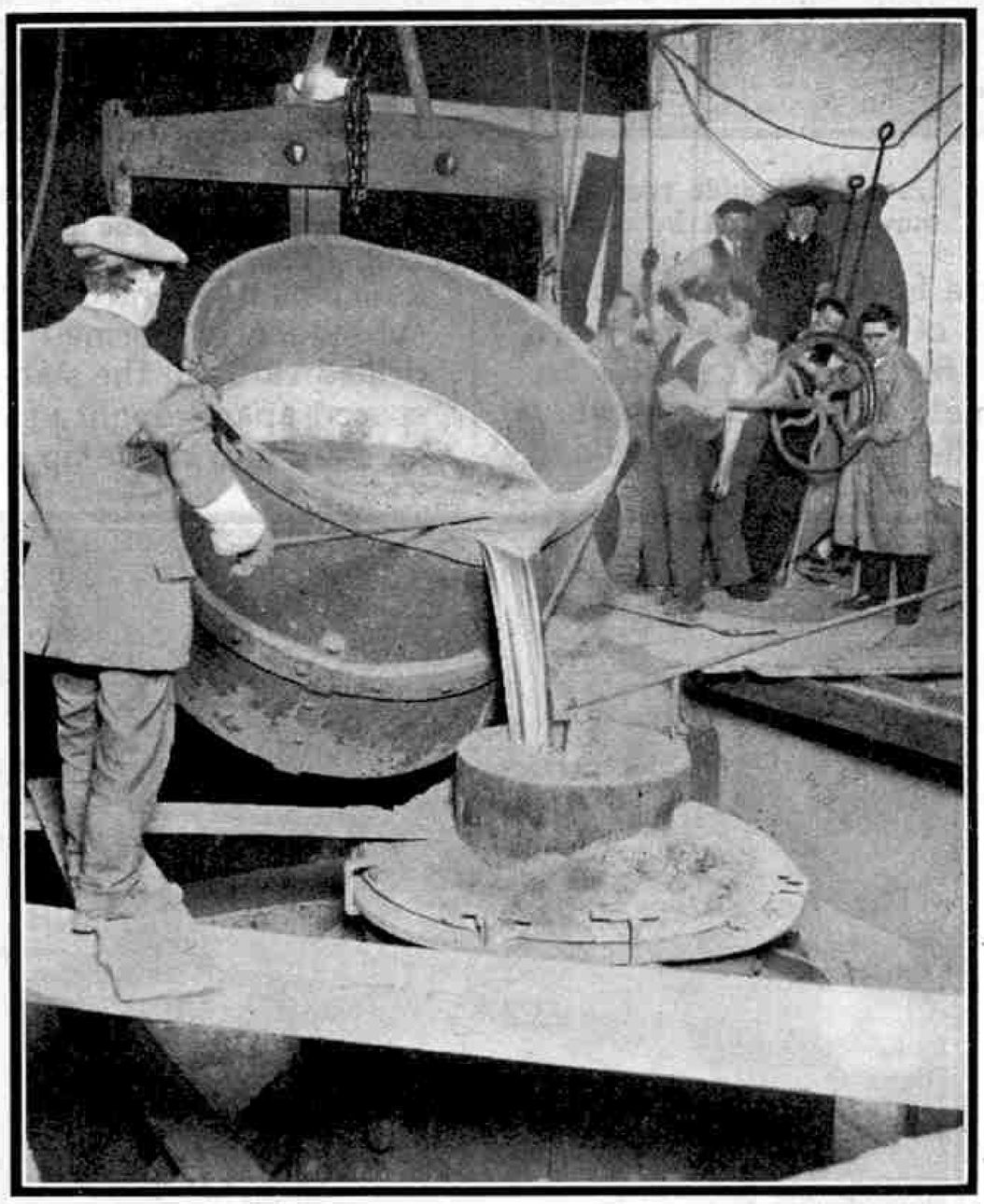
THE origin of bells is shrouded in mystery, but it is certain that they have been associated with religious ceremonies from a very remote period. Primitive bells have been found in Egyptian tombs and the festival of the Egyptian goddess Isis was celebrated with the music of bells. The book of Exodus refers to the golden bells that were suspended from the robes of the high priest, and the prophet Zachariah speaks of bells as forming part of the decorative harness of horses. We are told that bells were in use at that period as ornaments to the garments of women and boys, but it is probable that these were not true bells but merely some kind of ornament that jangled as the wearer moved. From very early times shepherds have hung bells upon their sheep and this custom is said to have originated in the belief that to adorn a sheep with a bell caused the animal to flourish and fatten more rapidly.

It is not known when bells were first used in the Christian Church. Their introduction has been attributed to Paulinus, Bishop of Nola, Italy (400 A.D.), and at any rate it seems fairly certain that he was instrumental in having comparatively large bells installed in the turrets of churches. This practice extended gradually to other countries and in time the use of bells in connection with places of worship became general.

Bells were used in the services of the Roman Catholic Church from very early times. Among these were the Ave Maria bell rung at 6 o'clock and 12 o'clock to remind men of the necessity of prayer to the Virgin ; the Vesper bell, which was the call to evening prayer, and the Compline bell which indicated the last service of the day. Another special bell was the Sanctus bell used in the celebration of the Mass. Formerly this bell was hung in a small turret outside the church so that all who were within hearing distance might prostrate themselves. Then there was the Passing Bell, tolled when anyone was dying. This practice still exists but now the bell is tolled after death. In the case of excommunication by " Bell, Book and Candle," a bell was rung to call the people to the ceremony.

William the Conqueror introduced from Normandy the Curfew bell, which was rung at 8 o'clock in the evening as a signal that all fires and lights were to be extinguished. The object of the Curfew was to guard against the danger of fire, which was always present in those days when houses were invariably constructed of wood.

On two occasions at least bells have been used for very dreadful purposes. At the ringing of the Vesper bell on Easter Monday in 1282, a general massacre of the French people in Sicily began in Palermo and spread throughout the whole island. Some 8,000 persons are said to have been killed in Palermo alone, and the final result was that Spanish rule of the island succeeded French. On another terrible occasion, 24th August, 1571, the eve of the Festival of St. Bartholomew, bells gave the signal for the massacre of the Huguenots in France.



Courtesy [*Croydon Bell Foundry Ltd.*

Molten bell metal being poured into the mould. Note the hand wheel on the right by means of which the tilting of the ladle is controlled

Bells were first cast in England about the year 940, and it is probable that the earliest bell founders were monks and priests. The names of these early workers are lost to us, however, for the custom of engraving the maker's name upon a new bell is of comparatively recent origin. As time passed on, the numbers of bells required increased rapidly, and the art of bell founding passed from monastic hands to the professional worker. In 1483 an Act was passed forbidding foreign bells to be imported into this country, from which one may assume that the home industry was being seriously threatened. The art of bell founding had reached a high state of perfection in Holland and Belgium about that time and probably the Act was directed against these countries.

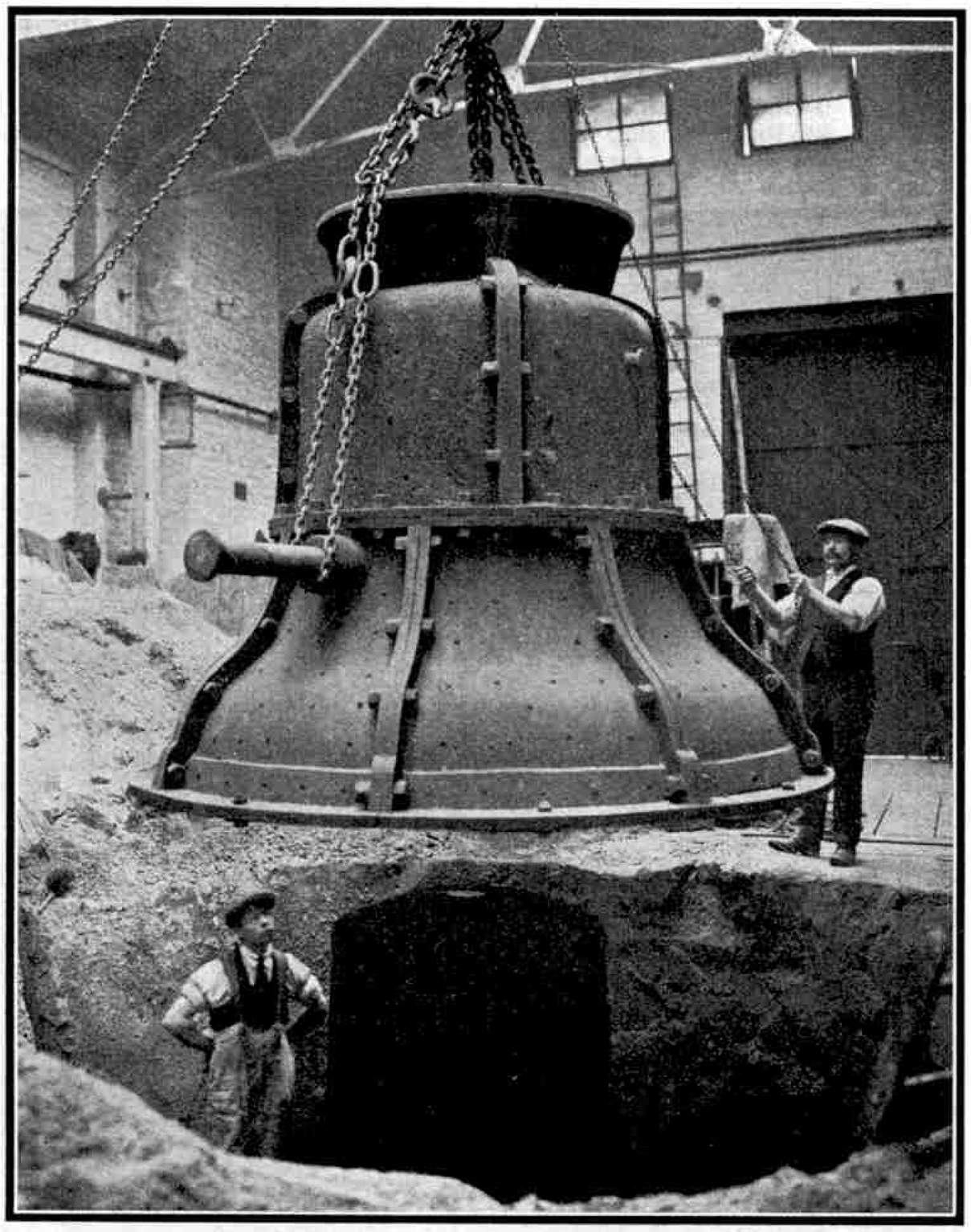
Many of the early English bell founders had no fixed place for working but travelled about the country, building temporary foundries at convenient centres and there casting such bells as were required in the locality. Thus, in 1732, one Henry Bayley advertised his readiness " to cast any ring or rings of bells in the town they belong to." As new bells were not required every day it was often the custom for a bell founder to fill up his spare time by working at some other trade, which sometimes might be a curiously incongruous one, such as that of a tailor.

York Minster contains two interesting reminders

of early bell founders. The first is a memorial to some unknown master of the art and takes the form of a cross, at one side of which is shown a brazier and at the other an antique bell. The other is the "Bell Founders" window containing stained glass representations of the old-time methods of bell casting including the forming of the mould and the filling of this with molten metal. Numerous small illustrations of bells occur in the coloured borders of the window.

It was not unusual for itinerant bell founders to set up their temporary foundries in the grounds of the churches for which they cast bells. Probably they were granted this unusual liberty on account of the difficulties of transporting heavy masses of metal along the badly made roads of those days. No doubt the bell founders were very glad to be able to carry out their work so close to the spot where the bells were to be raised. During excavations in the churchyard at Scalford in Leicestershire, in the 18th century, traces of a furnace together with a mass of bell metal were discovered. The bells of Meaux Abbey were cast within the precincts of the building, and the bells at Feering in Essex are said to have been cast in a field adjoining the churchyard.

As improved mechanical appliances became available and the art of tuning was better understood, bells of considerable size were produced. "*Great Peter*" of York Minster was cast in 1845 and is said to weigh 10¾ tons. It was the biggest bell in this country until "*Great Paul*" was produced in 1881 at a cost of £3,000. This bell weighs 16¾ tons and, as its name implies, is installed in St. Paul's Cathedral, London. The largest bell ever made in England, weighing 19 tons, was cast last year at the Croydon Bell Foundry Ltd. for the Laura Rockefeller Memorial Church in New York.



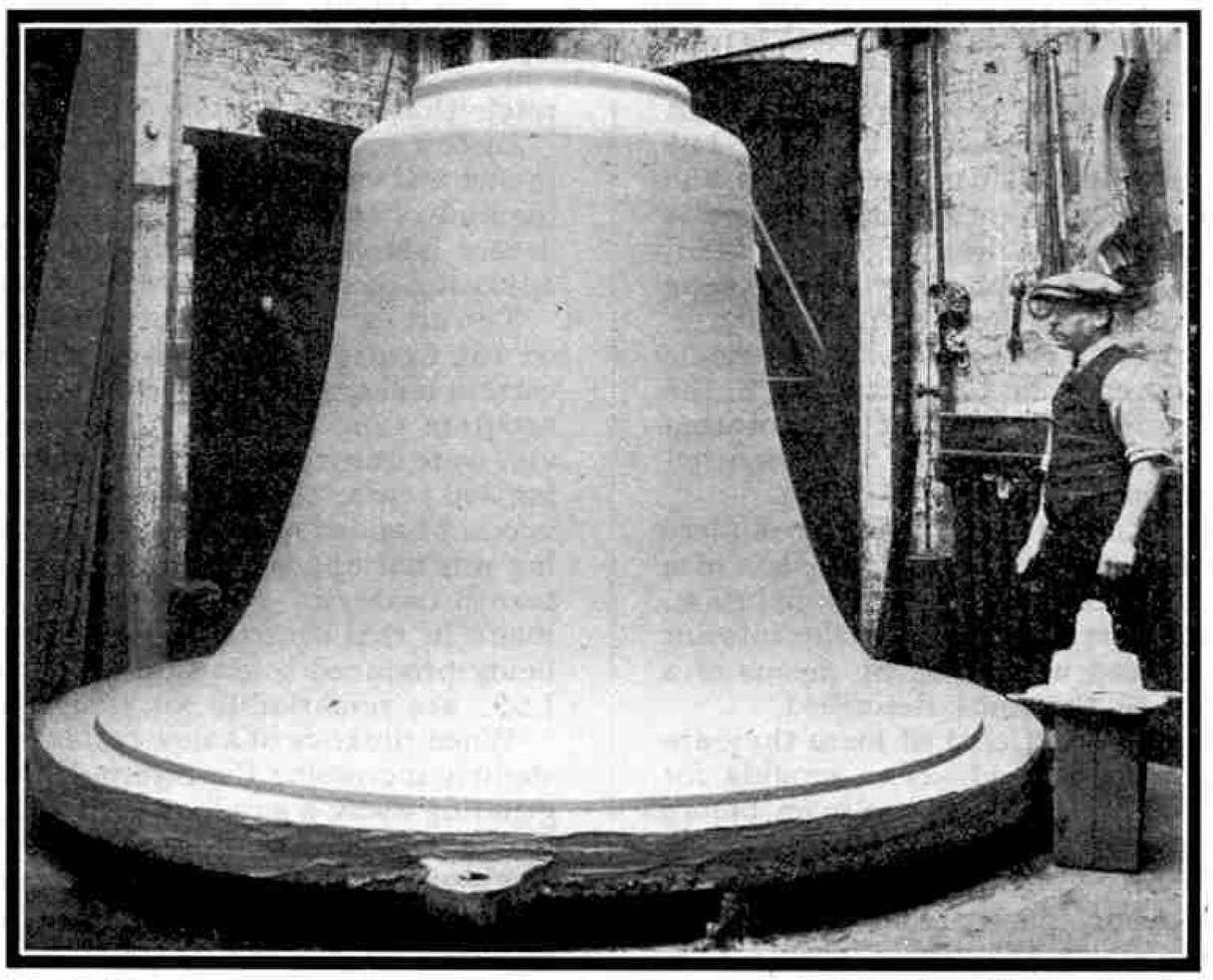
Courtesy] [*Croydon Bell Foundry Ltd.*

The segmented cope or outer mould being lowered into position over the core in the earthen pit

Some of the largest bells ever produced have been cast in Russia, including one 80 tons in weight cast in 1819, and another 128 tons in weight, presented to the Cathedral of Moscow by the Czar Boris Godunof. The largest bell in the world is the "*Great Czar*," built at Moscow. This bell was cast in 1773 and weighs 198 tons. Unfortunately the great bell cracked during founding and a piece 11 tons in weight broke away. The bell was never hung but was mounted on a special platform, and in this position it is still to be seen in the Kremlin. The bell is 19 ft. in height and 60 ft. in circumference.

Modern bells are made of a special metal consisting of a mixture of copper and tin, but in ancient times other metals were often either allied with the copper or used exclusively. In France iron was often used, while in this country and in Italy brass was employed. The monastic bell founders of old believed that the inclusion of silver improved the sound of a bell. On one occasion the Emperor Charlemagne admired the tone of a bell cast in the Abbey of St. Gall by a well-known monk founder. The monk was a great enthusiast and at once replied: "My Lord Emperor, command a great quantity of copper to be brought to me, which I will purify by fire, and let me have silver instead of tin, about a hundred pounds, and I will cast for you such a bell that others in comparison with it shall be mute."

During the era of the monasteries it was customary for the people of a parish, the church of which was to be equipped with a bell, to meet the cost of this luxury not only by cash



Courtesy] [*Croydon Bell Foundry Ltd.*

A large bell casting after the removal of the mould

subscriptions but by giving " kitchen utensils of copper or brass, tin or lead." An interesting sidelight upon the material utilised in bell founding during the 13th century is given in an old record of the casting of a bell for Bridgewater. The record states that 896 lb. of copper, 40 lb. of brass and 320 lb. of tin were purchased, while gifts of " pots, platters, basons, lavers, kettles, brass mortars and mill pots," apparently all of brass and totalling 180 lb. in weight, were made by the people of the parish. The composition of the new bell also included the old bell, 425 lb. in weight, which was melted down, thus providing some very valuable material.

Gold and zinc have been employed as an amalgam in small bells, while at one period toward the close of last century steel bells were produced by a foundry in Westphalia, Germany.

About the time of Henry III the proportions of copper and tin used in bell metal were in the ratio of two to one. For small bells the general standard nowadays is three parts of copper to one of tin, and for large bells four parts of copper to one of tin. Great care is exercised to ensure that the metals are used in the correct proportion, for if the amount of tin is excessive the bell is rendered more brittle, while if too much copper is used the brilliancy of the tone is damaged.

It is of great importance that the bell should be accurately proportioned and the various dimensions are carefully calculated in terms of " brims." The brim is the thickness of the metal at the part of the bell where the clapper strikes. The diameter of the bell at the mouth is made to equal 13 to 15 brims, and the diameter on the shoulder is made slightly more than half that at the mouth. The external height of the bell from lip to shoulder equals 12 brims, while the upper part of the side of the bell is made two-thirds of the thickness at the base.

The first step in the casting of a bell is the making of the mould, and this is constructed in two parts, the outer and the inner moulds. The outer mould, known as the " cope," is built up of cast iron sections shaped to the contour of the bell, but slightly larger in size than will be the bell casting. When the sections of the mould have been bolted together the interior is coated with " loam "—a mixture of special adhesive kinds of sand, cow hair and other ingredients. The loam is plastered on the cope by means of a metal template known as the " strickle board," one edge of which is cut to the exact form of the bell. The strickle board is fixed to an arm that is pivoted upon a vertical bar in the centre of the mould, and while the loam is still soft the rotating board shapes and smooths it until, little by little, the required shape has been accurately formed in the mould.

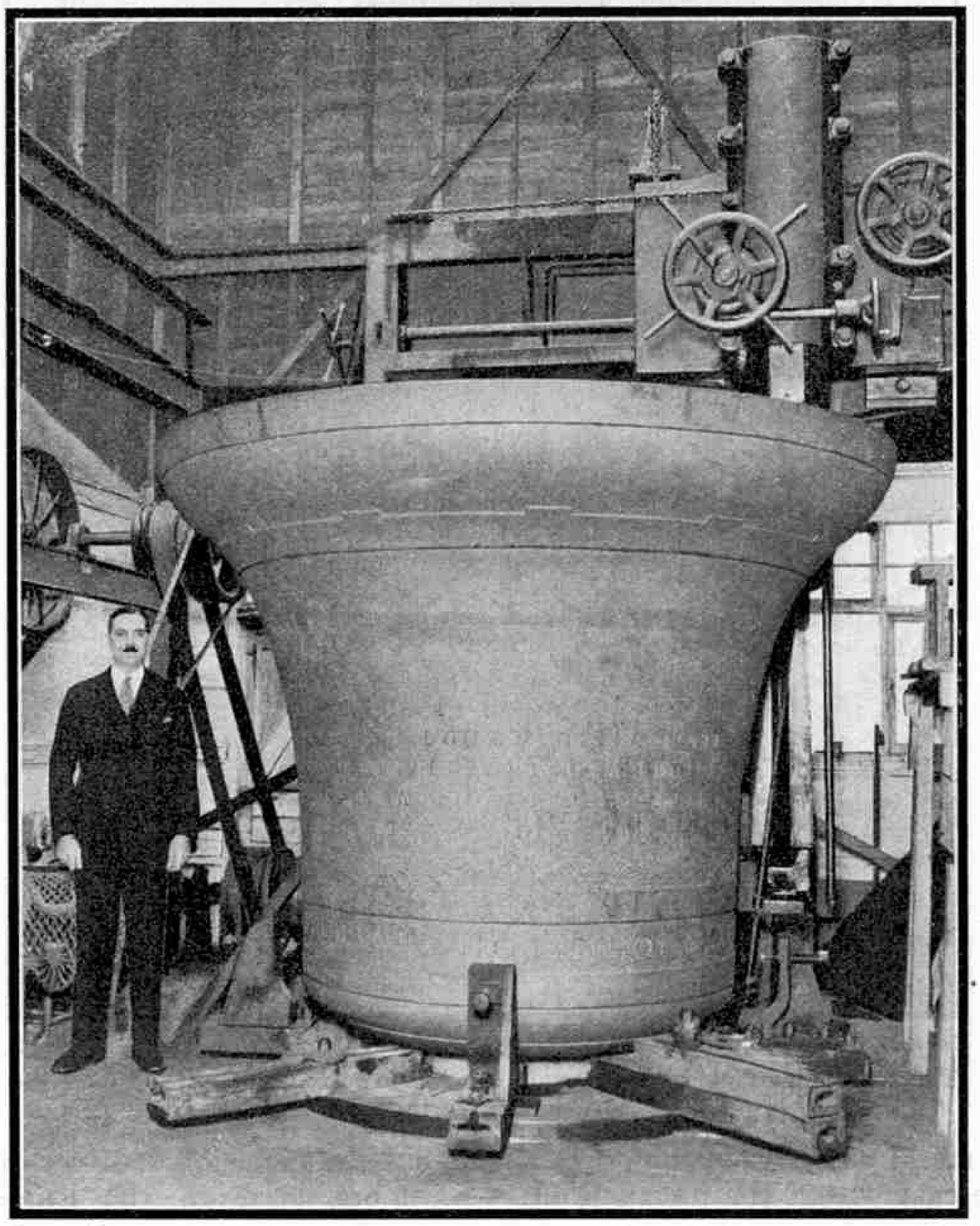
The inner mould, called the " core," is the portion of the complete mould that shapes out the interior of the bell, and it consists of a structure built up of brick, with a cast iron plate as a foundation. The core is made slightly less in diameter than will be the interior of the bell, and when ready it is coated with loam by means of a strickle board in a similar manner to that just described.

When the moulds have received their first coat of loam they are placed in large ovens to be thoroughly dried. The moulds for bells of medium size require two or three days in the oven before they are sufficiently baked, while a longer period is necessary in the case of those for larger bells. When the plaster is thoroughly dry the moulds are removed from the ovens and coated a second time with a finer mixture of loam, after which they are returned once more to the ovens to be dried. The next process is blacking the moulds and sleeking the surfaces so that the castings may come out clean and smooth. It is at this stage that any ornaments or inscriptions that may be required are stamped on the lining of the outer mould, and this operation requires great care.

The casting of medium and large-sized bells is carried out in earthen pits into which the moulds are lowered. The core is placed into position first and the cope, or outer mould, then fitted over it. The combined mould is now ready to receive the molten metal. In preparing the metal for the bell the copper is melted down first, and the tin, which is more quickly melted, is then added. Bell casting is carried out in the same manner as ordinary metal casting, the molten metal being conveyed to the mould in a huge ladle by means of a travelling overhead crane. When the mould is reached the ladle is slowly tipped over and the glowing liquid flows downward through an aperture in the top of the mould.

The period allowed for the cast metal inside the mould to set sufficiently solid to be touched varies from one to four or five days according to the size of the bell. If the bell is of medium size the cope may be removed on the day succeeding the casting. The bell is then lifted by means of the overhead crane and, after the core has been knocked out, is trimmed and sandblasted so as to remove the black and grease adhering to it from the mould. When these operations have been carried out the bell is conveyed by the crane to a temporary frame, upon which it is tested for tone.

The type of tone, or pitch, of a bell is determined by its shape and weight. By means of a definite formula a bell founder is able to produce bells of any prescribed pitch. The tone of a bell is the result of vibrations set up when the bell is struck, and the number of these vibrations occurring in a given period varies, directly, as the square of the thickness of the bell. Inversely, the number varies as the diameter of the bell, or as the cube of its weight. Although two bells may be cast from the same mould there will be fine differences in their pitch that only a trained ear can detect.



Courtesy] [*Croydon Bell Foundry Ltd.*

A 15½ ton bell for the Wanamaker Store, Philadelphia, U.S.A., on the tuning machine, 1926

In testing the tone of a bell the latter is struck with a wooden mallet and the note that is sounded is compared with the corresponding tone of an ordinary tuning fork. The experienced bell tuner can detect instantly any difference between the two sounds, but the adjusting of this fine difference is a highly skilled job.

The art of bell tuning attained to a very high degree of perfection on the Continent several centuries ago. In Belgium and Holland certain bell founders achieved such purity of tone and comparatively accurate tune that their bells became famous throughout Europe and were unsurpassed by any that were produced during the following 300 years. The skill and knowledge these old masters possessed was not handed on to their successors, however, and their skill in tuning was not approached in England until the latter half of the nineteenth century. During the last 25 years great strides have been made in this country in the art of tuning and the bells that are being produced to-day by such firms as the Croydon Bell Foundry Ltd., are remarkable for their purity of tone.

When the tone of a new bell is found to be too high, it is lowered by slightly increasing the internal diameter of the bell. This is done by grinding away a small quantity of metal inside the lower half of the bell, a portable grinding machine being used for this purpose. If the pitch of the bell requires to be raised however, a small quantity of metal is removed from the outer edge of the bell by means of the machine. Only the absolute minimum amount necessary is filed away as the removal of a substantial quantity of the metal would ruin the quality of tone.

(*Continued on page 425*)

XI.—FROM FOREST TO PAPER MILL

LAST month we traced the history of paper from its discovery by the Chinese to the invention of the machines on which it is now manufactured. On these machines paper is made in the same manner as in the moulds used by the paper-makers of past centuries, but the work is carried on more speedily, and a wider range of pulping materials is now available for use.

For the beginning of the story of the manufacture of paper we must go to the huge pine forests of Scandinavia or of North America, for these are the chief sources of the wood pulp from which the great part of the paper used to-day is made. The trees that are most valuable for this purpose are spruce, pine, and balsam fir.

The first step naturally is to fell the trees, and in North America and Canada most of this work is carried on in winter. As soon as the cold weather comes the gangs of lumbermen build their log huts in the forests, and there, far away from civilisation, they spend strenuous days cutting down giant pine trees with axe and saw, and trimming off the useless branches. The work is hard and calls for both skill and strength, but the life is healthy and full of romance—although there may not be quite so much of the latter as story books would have us believe!

After trimming, the logs must be despatched to the sawmills, and the method by which this is done depends upon the position of the logging camp. In some cases the timber is moved on sledges drawn by caterpillar tractors over tracks covered with ice, the slippery roadway being flooded periodically in order to produce a new and unworn surface by freezing. In other cases, logs are hauled on bogies mounted on light rails laid down for the purpose.

The favourite method of transporting logs, however, is, and always has been that of floating them down rivers to mills situated on the river bank. This, of course, cannot be done in winter when the rivers are frozen over. Until the thaw comes the logs are piled up on the bank of the river, and when the ice breaks up and the floes move downstream, the timber is skidded into the water to follow them. The logs are carried down rapidly by the current and, if all goes well, they reach the sawmill in a very short time. Rivers have bends and shallow stretches, however, and at times in these places a log becomes jammed in such a position that it obstructs other logs, and finally holds up the traffic completely. The lumbermen have to be constantly on the alert to prevent this from happening, for a big log jam is dangerous as well as being a nuisance. It acts as a dam for the rushing water of the river, and if it is not quickly removed it may cause a serious flood in the surrounding country-side.

Courtesy [*Canadian Government*

Log jam on a Canadian river. Setting free the thousands of logs held up in jams of this kind is one of the lumberjack's most dangerous tasks

In spite of every care, a jam now and then assumes serious proportions, and immediate and drastic steps must be taken to break it up. In the old days a lumberman wearing boots with long spikes went out across the pile of penned-up logs, the spikes giving him a precarious foothold as he leaped from one log to another. With a long staff he would then poke and pull at the logs until he found the "key-log," that is, the one that was holding up the rest. If he was fortunate, he would be able to work this log out of the way, and the timber would once more continue its way downstream. If the break-up occurred fairly quietly the lumberman would be able to regain the bank in safety. Occasionally, however, the freeing of the key-log caused such an avalanche of timber, that the unfortunate lumberjack was swept away to a terrible death.

To-day safer and, at the same time, more effective methods are employed. If a jam cannot easily be

dispersed the lumbermen plant a few sticks of dynamite in the worst portions, light the fuse, and then make quickly for the bank to await the explosion. Then comes a loud report, fragments of logs fly up into the air, and if the dynamite has been well placed, the logs are freed and once more renew their journey.

An interesting, but not often used method of floating logs down to the sawmills, is that of making them up into an enormous raft. The lumbermen make their home on this, and float with it many miles downstream. Naturally it is not by any means easy to tie thousands of logs together in a really secure manner, and many accidents have occurred through such rafts breaking up unexpectedly. At one time many of them were to be seen on the broad waters of the Mississippi, but now they are not often met with so far from the forests and mountains, for the sawmills have been moved nearer to places where timber grows.

Chuting logs into a British Columbia waterway. The log that is entering the water has descended from the hillside forests in the flume seen in the foreground

When trees growing on the slopes of mountains are being felled, the logs are often brought down to the mills or to the banks of a convenient river by means of "slides." In some cases, these slides are merely channels of timber, sufficiently wide to accommodate single logs which slide down under the influence of gravity. A more picturesque method is to send the logs down a flume or channel into which water has been diverted from a convenient stream. The water rushes down the flume with great speed and the logs are rapidly carried along with it.

Photos courtesy] [*Canadian Government*

Skidding logs from a sledge into the river that carries them down to the pulp mills

On arrival at the mills the logs are arrested by a barricade in the river, and lumbermen armed with long poles guide them to the foot of an endless chain hoist. Cleats or fasteners then grip the logs and carry them into the mill, where they are quickly cut by enormous circular saws into shorter pieces measuring about 2 ft. in length.

Before reaching the saws the logs are often given a shower bath of hot water! The purpose of the powerful spray that is directed against them is to remove stones and grit, embedded in the bark, that would be harmful to the teeth of the saws. It is interesting to know that circular saws are often provided with false teeth! A saw is rendered useless by the breaking of a certain proportion of its teeth, and in order to prevent waste these are now being made detachable. The replacement of damaged teeth is the work of a few minutes only.

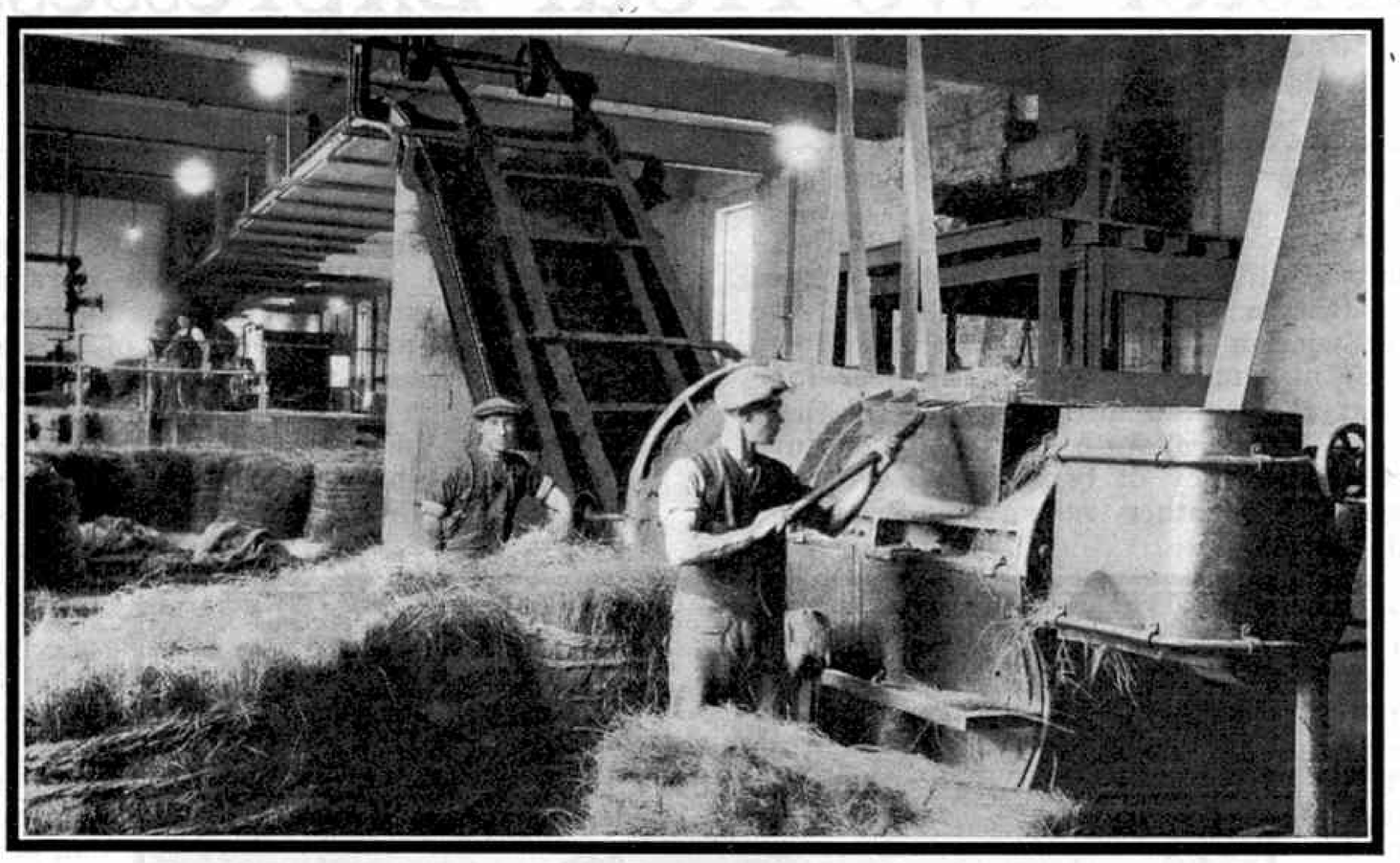
Before the wood is made into pulp the bark has to be removed. This is done by workmen who wield enormous spokeshaves, or by revolving discs that carry knife blades on their edges and are fixed at such a height that they peel the bark off the timber as it is pushed beneath them.

The further treatment of the wood depends upon the kind of paper that is to be made from it. If it is intended for the production of low-grade paper of the kind largely used for newspapers, its fibres are dragged apart mechanically by an emery or sandstone cylinder. The wood is crushed against the base of the grinding machine, and the roughened faces tear it to pieces. During this process a stream of water flows through the machine, in order to keep the temperature as low as possible. The rough pulp that is made is passed through a screen in order to separate out dirt and large splinters, and is then pressed into boards and exported under the name of mechanical wood pulp.

This grinding process is too rough and drastic for wood that is to be used in the manufacture of better class paper. Mechanical wood pulp retains practically all the resin and sap of the wood from which it is made, and paper containing it quickly becomes discoloured and brittle. This is the reason why modern newspapers are not permanent. The combined effects of handling and exposure to the air cause them to crumble, and a New York Library expert has expressed the opinion that in another 100 years the newspapers of to-day that are preserved in public libraries will have become mere masses of sawdust, streaked with traces of ink. In the United States, copies of newspapers intended for preservation are specially printed on paper made from rags, as this is far more durable.

Fortunately wood may be disintegrated by chemical

means, and from the pulp that is made, excellent paper is produced. Chemical wood pulp is made by boiling with soda, calcium bisulphite or sodium sulphate. The boiling is carried on in the same manner, whichever chemical is used, and as the paper used for printing the "*M.M.*" is made from sulphite pulp, we shall trace the steps by which the wood is transformed into this particular pulp.



Bales of esparto in a paper mill. The grass is being thrown into a machine that removes stones, sand, and dust before it is boiled with caustic soda

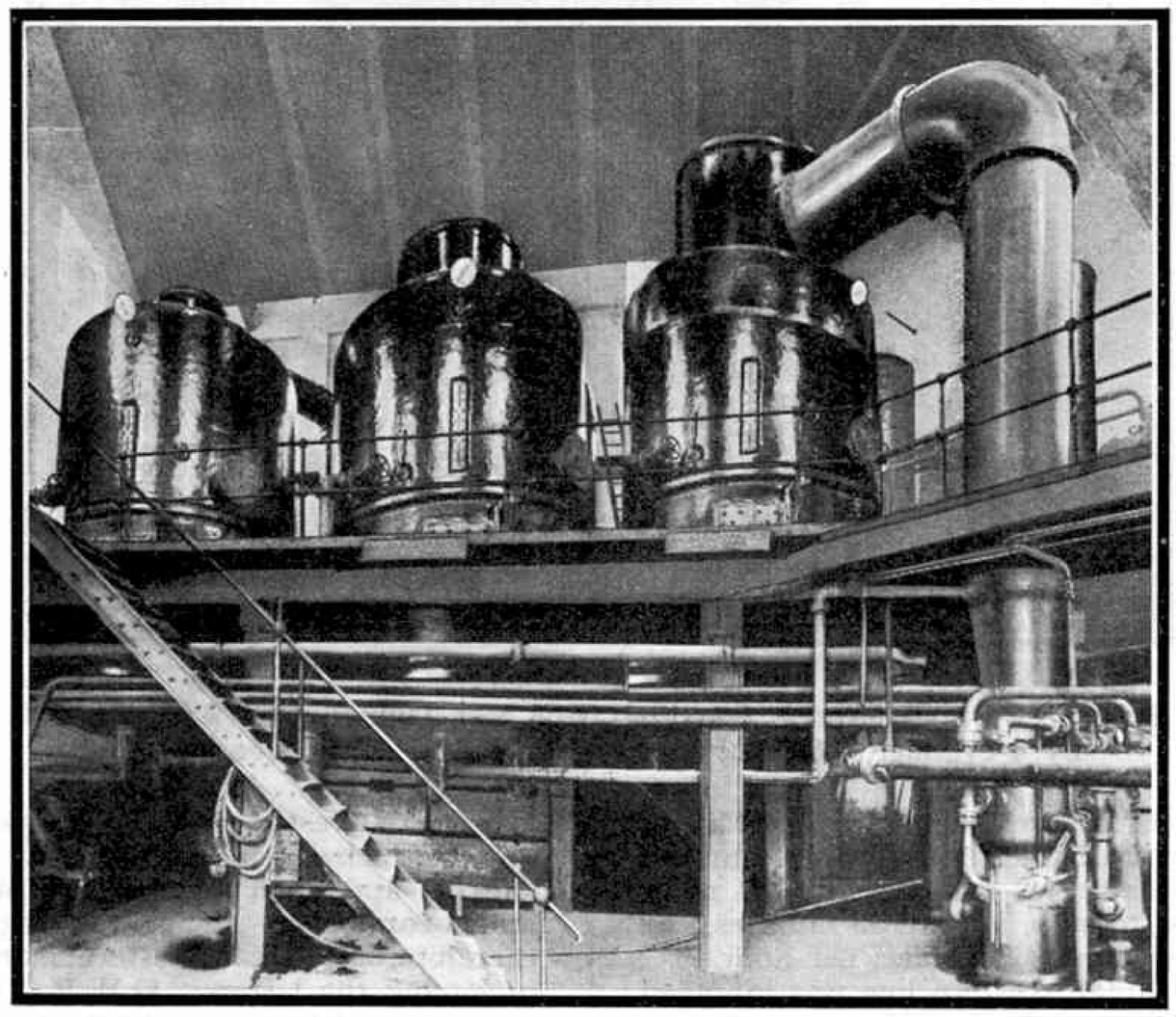
Logs that are to be boiled with bisulphite are cut up in exactly the same manner as those used for making mechanical wood pulp. In order to enable the chemical to penetrate more easily into the wood, however, the cut lengths are reduced to chippings from $\frac{3}{8}$ in. to $\frac{3}{4}$ in. in length, by passing them through a machine containing revolving knives. The chips are screened to remove dust and dirt, and are then fed in through the manhole of a giant boiler or "digester." This is made of steel, and is lined with brickwork or similar material that resists the corrosive action of the bisulphite. The digesters are very large and many of them are capable of holding as much as 20 tons of wood.

In the meantime the acid liquor is prepared by burning sulphur or iron pyrites in kilns, and passing the resulting gas through towers containing limestone. Fine streams of water flow down the towers and carry away in solution the calcium bisulphite thus formed.

A sufficient quantity of the acid liquid from the towers is poured on the wood in the digester, and this is sealed up. Steam at a pressure of from 80 to 100 lb. per sq. in. is forced in and the cooking is continued for nine or ten hours. The contents of the digester are then blown out into a pit with a perforated floor through which the liquid drains away, leaving behind it a pulpy mass. This is washed with water and is then pressed into thick sheets of a size convenient for handling. At this stage it is known as "half-stuff," and it is in this condition that the material usually is transported to the paper mills.

Wood pulp that has reached the stage of "half-stuff" is not yet in a condition for making into paper, however. It is usually yellow in colour, instead of pure white, and its fibres have not been sufficiently separated to enable a fine sheet of paper to be made from it. Before passing on to the paper-making machine it must be bleached, and thoroughly beaten in order to reduce it to a finer pulp.

Bleaching is the first operation that the rough pulp undergoes. For this purpose the "half-stuff" is mixed with water and broken up in machines that are known as breakers." A solution of bleaching powder is then added, and a gas chlorine is liberated and destroys the coloured impurities. Great care must be taken not to carry the bleaching process too far, for then the chlorine would attack the fibres themselves, reducing their strength, and thereby resulting in the production of an inferior quality of paper.



Photos courtesy] [*Guard Bridge Paper Co. Ltd.*

Triple evaporator plant for concentration of waste liquor in which esparto grass has been boiled. From 80 to 90 per cent. of the soda used is recovered by evaporation

After bleaching, the pulp is thinned with water and run on to a travelling belt of wire cloth called the "presse-pâte." As the liquid is carried along, the water runs away through the cloth, leaving behind the fibres in the form of a sheet of purified pulp that resembles wet thick blotting paper. This pulp is passed between rollers in order to squeeze out still more of the water, and is then ready for the very important process known as beating.

When the purified wood pulp is ready for the machine in which beating is carried on, it is often mixed with pulp made from rags, esparto, or straw. Although wood is now the chief source of paper, the materials formerly used have by no means been displaced and are very largely used for paper intended for special purposes. Rags have always been regarded as ideal for making high-grade paper, while esparto has been greatly favoured in Great Britain, and is still used on a large scale.

Rags vary very considerably in (*Continued on page 425*)

FAMOUS TRAINS: XXVIII

The Bristol Two-Hour Expresses, G.W.R.

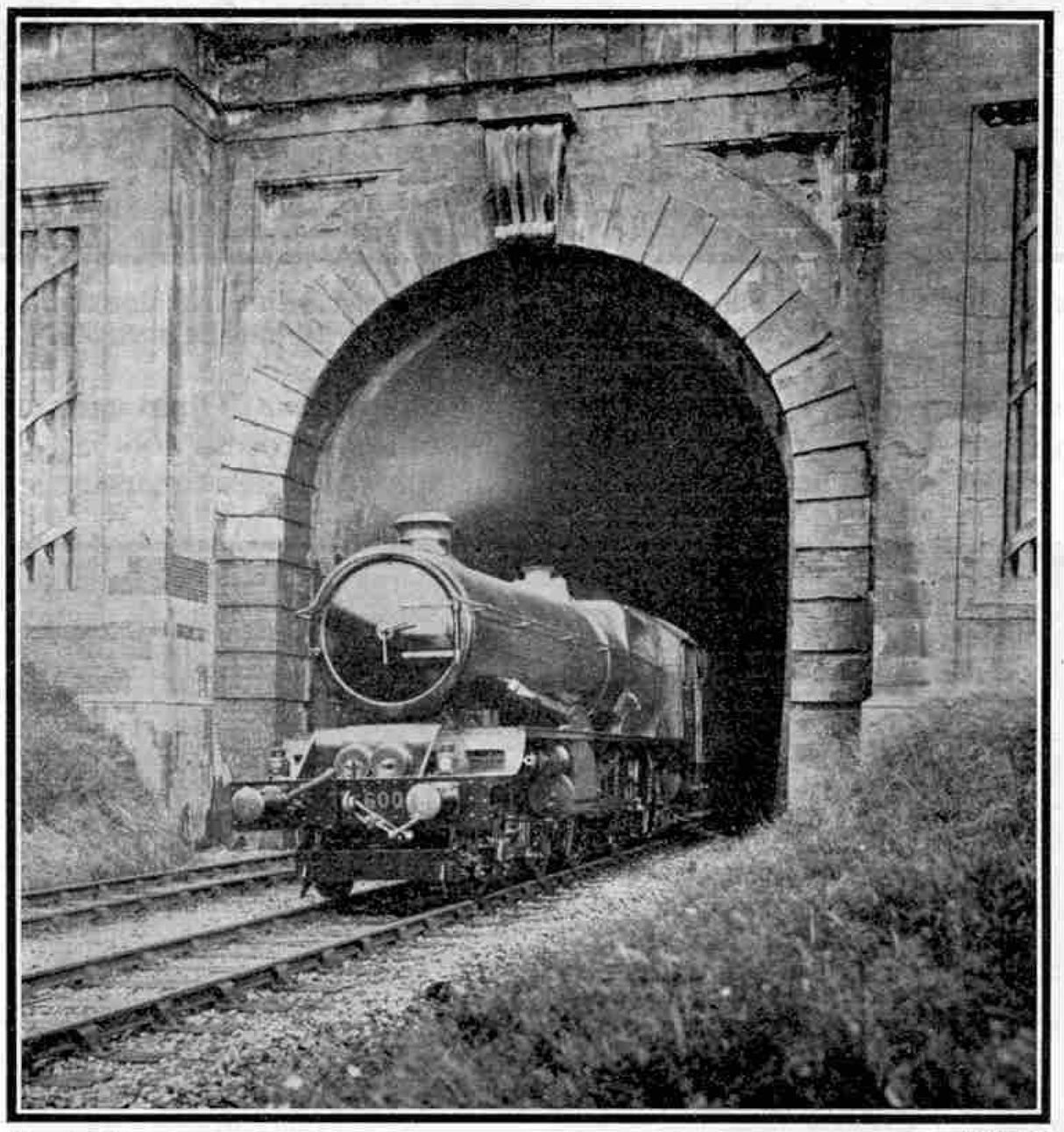
By Cecil J. Allen, M.Inst.T., etc.

THROUGHOUT their history the Great Western Railway Company have taken a leading part in the development of rapid travel in Great Britain. For many years past the locomotive authorities at Swindon have laid themselves out to produce engines capable of maintaining high speeds over long distances continuously, and the traffic authorities, with these locomotives at their command, began, about a quarter of a century ago, to embark on a deliberate policy of bringing the West of England nearer to London. On other railways acceleration has often been the result of competition, but without any such spur (except as regards Exeter and Plymouth in the West, and Birmingham and other important towns in the North) the Great Western have speeded up their train services in every direction, until now they lay claim to most of the premier places in the table of fastest runs performed daily in the British Isles.

The train service by which we are to travel this month occupies some specially high places in this list. To reach Bristol in two hours from Paddington, as is done by two trains daily, entails an average speed of 59.2 miles per hour, for the distance covered is 118.3 miles by the Bath route. The Badminton route, used by the two up two-hour expresses, is only a shade shorter, and the average in this case is 58.8 miles per hour. But still more remarkable is the fact that both of the two down expresses mentioned—the 11.15 a.m. and the 1.15 p.m. out of Paddington—carry on the rear slip portions for Bath, which are booked to be deposited in the station of the famous spa exactly 1¾ hours after starting. The distance from Paddington to Bath is only a fraction under 107 miles, so that for over 100 miles of their journeys each of these expresses has to travel at an average rate of 61.1 miles per hour. Similarly on the up journey, the allowance made by the timetable for running the 100 miles from Badminton to London, pass to stop, is only 95 minutes, the average rate required in this case being 63.2 miles per hour.

Right from the beginning the Great Western line was intended to be a speed line, and was laid out accordingly. Favoured by the nature of the intervening country, Isambard Kingdom Brunel, its first and probably its most famous engineer, carried his track up the Thames Valley nearly to Didcot, and then struck across level country to Swindon, whence he was able to drop into the valley of the Bristol Avon, near Bath, ere he emerged on the shores of the Bristol Channel, and pursued its left bank for the best part of the way to Taunton. The fall into the Avon Valley made necessary the only appreciable gradients in the whole of this distance of over 150 miles—at 1 in 100 for 1½ miles between Wootton Bassett and Dauntsey, and chiefly at the same grade for 2½ miles through the Box Tunnel, which in its turn is the chief engineering work on the route. The Great Western is the only level main line out of London, taking its course up the river valley instead of having to rise in order to make its exit over the ring of hills that encircles London both north and south.

There could hardly be a more extraordinary contrast between two railway routes than there is between the one over which we travelled last month and that of this month. The "*Engadine Express*" finished its journey over gradients stiffening finally to 1 in 40 and 1 in 29, in long stretches; the Bristol two-hour trains, on the down journey, have to face nothing steeper than 1 in 660 against the engine, and for a large part of the journey the "ruling," or steepest gradient, is 1 in 1,320, or one foot rise every quarter-mile! It is singular to notice, however—and the fact is quite apparent when one is taking accurate record of the speeds—that even 1 in 1,320 makes an appreciable difference in the speed when the train is travelling fast, up to a maximum variation of perhaps five miles per hour, according to whether this modest inclination is "up" or "down."



Courtesy] [*G.W.R.*

Bristol Two-hour Express emerging from Box Tunnel, near Bath, hauled by 4-cylinder 4-6-0 locomotive No. 6000 "*King George V*"

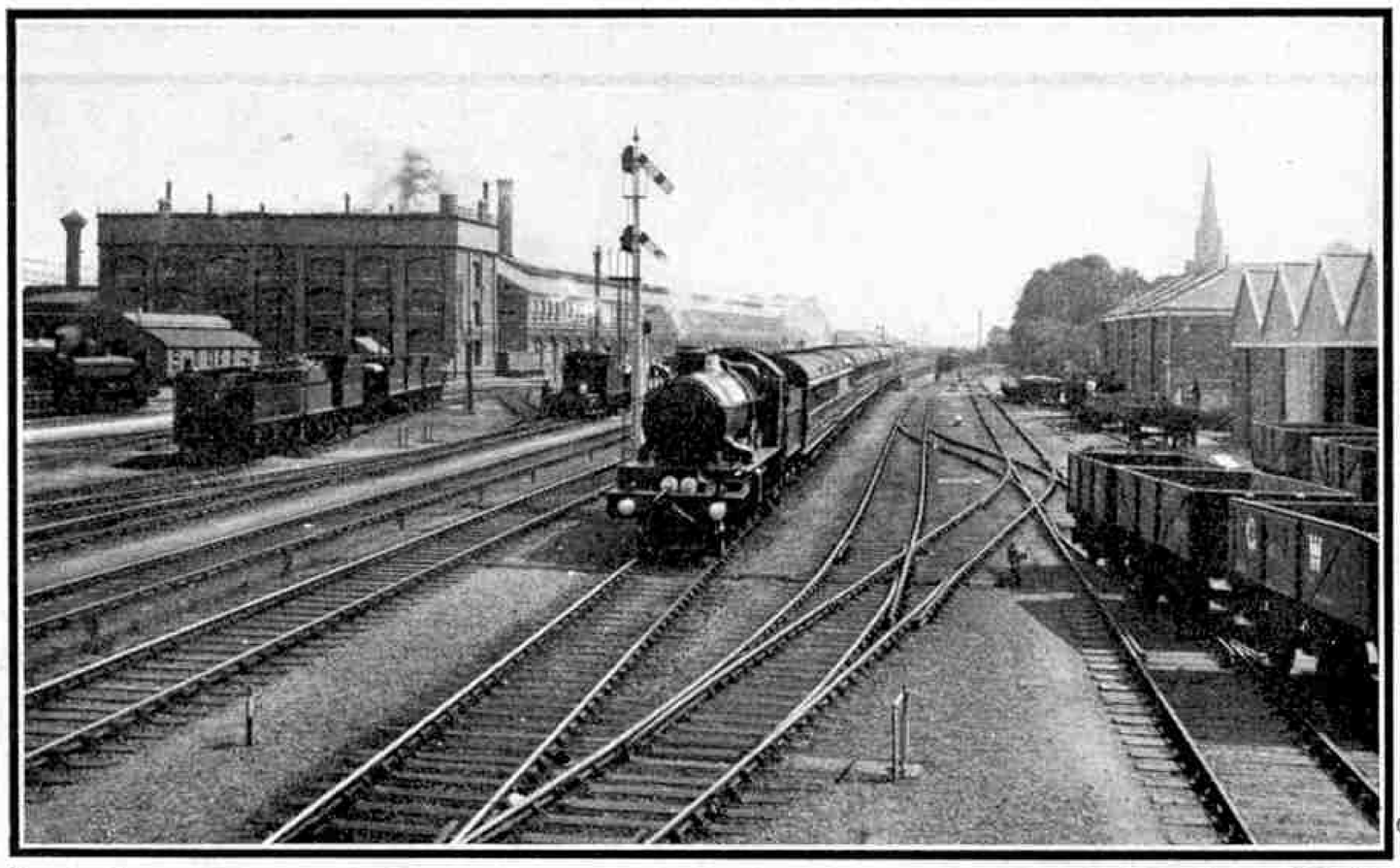
The "*Engadine Express*" carried us up to an altitude of 6,000 ft. above the sea; the highest part of the Bath route from London to Bristol is not more than a couple of hundred feet above Paddington, with some 70 miles in which to overcome this trifling difference in level; though the Badminton route, used by the up two-hour trains, certainly goes over a greater altitude.

The Great Western main line from Paddington to the West of England via Bristol is a striking example of considering the gradients too much at the expense of distance. Brunel, by avoiding the hills, made his main routes so circuitous that in more recent years the London and South Western built a line shorter by 22½ miles to Exeter; while the London and Birmingham Railway, later absorbed in the London and North Western, was 16¼ miles shorter than the Great Western route, which diverged from the West of England main line at Didcot, and then turned northward through Oxford, Banbury and Leamington. Since the beginning of the present century, therefore, the Great Western management, to remove the stigma of having the letters "G.W.R." interpreted as the "Great Way Round," and to recover traffic that was being lost to their shorter and quicker rivals, have been compelled to spend large sums of money with a view to cutting the corners off their main routes.

From 1901 onward, indeed, a total of 160 miles of cut-off routes have been opened in various directions—the Westbury route to the West of England, the High Wycombe route to Birmingham and, among others, the Badminton route to South Wales, over practically the whole length of which we travel on our up two-hour journey from Bristol to Paddington. All the original lines planned by Brunel are still carrying important traffic, however, and on our down journey to Bristol we travel throughout over Brunel's earliest route, on which the only changes of note have been that certain important stations—such as Reading—have been entirely rebuilt and rearranged, while the "Broad Gauge" track that Brunel laid, with 7 ft. between the running faces of the

rails, has inevitably given place to our standard figure of 4 ft. 8½ in. The only present reminder of the Broad Gauge is seen in the distance between the up and down lines at many points, especially at stations, where the outside rails were left in their original position, in order that it might not be necessary to shift the platforms, while the inside rails were closed up by the difference between the two gauges, which involves a "six-foot" of proportionately increased width. The Great Western are the only British railway company that can place their signals, when they desire to do so, with their posts between the up and down tracks of a double line.

Another reminder of Brunel's day may be seen in some of the sidings by the side of the line, which are still laid as he always laid his track, with what are called "bridge" rails fastened down to longitudinal sleepers, in their turn kept at the correct distance apart by wrought iron tie-bars. In comparison with journeys over other lines, travellers of this period always maintained that running over the GreatWestern had no superior anywhere. Whether this was mainly due to the Broad Gauge, or to Brunel's methods of track-laying, has never been satisfactorily settled.

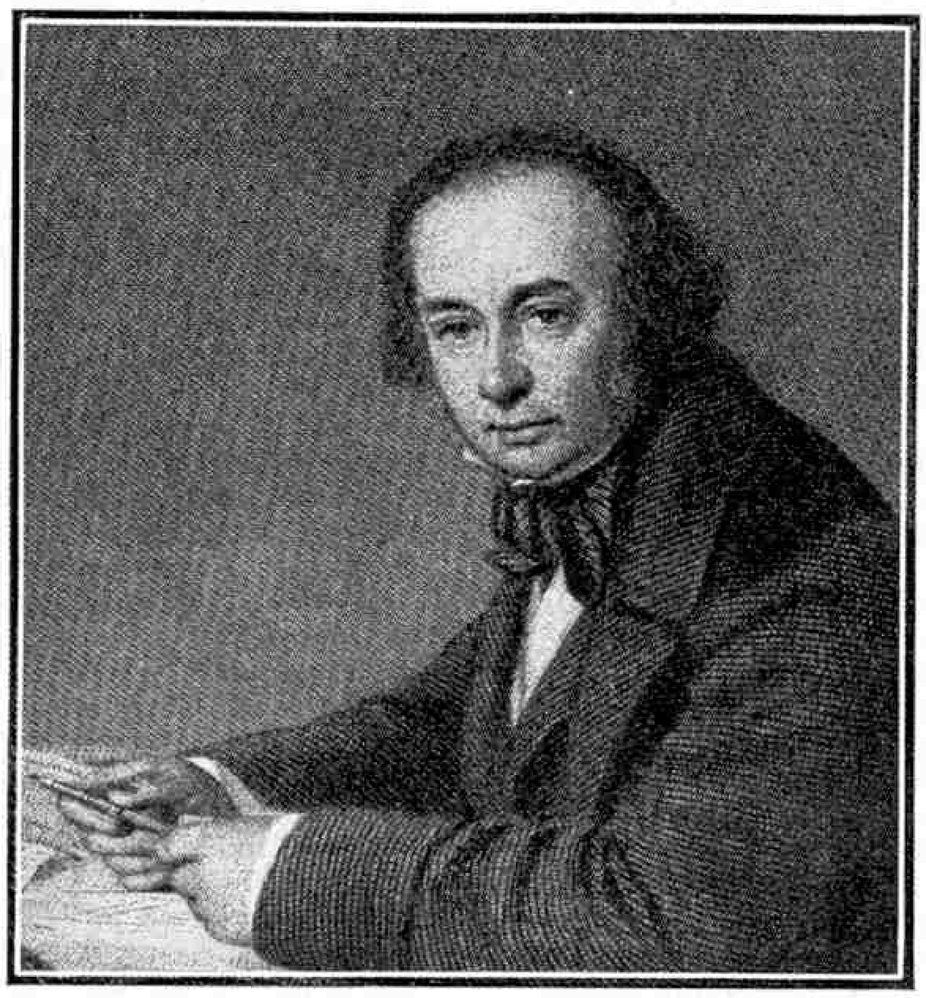


Courtesy [*G.W.R.*

Bristol Two-hour Express, hauled by "Castle" class locomotive, passing Swindon Works at full speed

It is now time that we began to think of our journey. In accordance with the sensible principle of systematic train departures that is now standard on the Great Western and Southern systems, we find that trains for the Bristol direction leave Paddington at 15 minutes past the hour. The two down two-hour trains make their exit at 11.15 a.m. and 1.15 p.m. Both of them, as we have seen, carry slip portions for Bath, which are labelled "*Bath Spa Express*," and the 11.15 a.m. has a further "slip" for Didcot, often consisting of three or even four coaches, because of the extraordinary number and diversity of the connections that it makes in different directions at Didcot. So, although the 1.15 p.m. seldom takes out of London, except on Saturdays, more than six or seven coaches, the 11.15 a.m. may be relied on to carry at least 11, with a total load, including passengers and luggage, of 370 to 375 tons for the first 53 miles of the journey. It is for this reason that the latter is now a booked turn for one of the latest four-cylinder 4–6–0 locomotives of the "King" class; and we shall, of course, make this the train of our choice for the run to Bristol.

The formation of the 11.15 down remains fairly constant. Throughout the winter the main, or Weston-super-Mare portion consists of five of the latest 60-ft. steel-panelled corridor coaches, with a 70-ft. restaurant car in the centre, the whole set having an empty weight of 195 tons. Next follows the Bath slip portion, which will probably be a couple of big 34-ton 70-ft. composite brakes, semi-corridor—that is to say, provided with a corridor along the coach, but not vestibuled to the train ahead. The Great Western authorities have never favoured the vestibuled type of slip coach that was used for a time before the war on the Midland and London and North Western Railways, allowing the use of the restaurant car until just before the slip was detached. Behind the Bath slip is the Didcot slip—a composite slip brake coach followed, usually, by a couple of "thirds." After being dropped off at Didcot, this portion of 85 or 90 tons' weight is worked through to Oxford. The Bath slip coaches, however, are simply taken over to the opposite side of the station, and just over an hour after their arrival are on the way back to Paddington by the 2.7 p.m express from Bath, due in London at 4.5 p.m.



Isambard Kingdom Brunel, the pioneer engineer of the Great Western Railway

As far as Swindon we travelled over this route before on the "*Fishguard Boat Express*," so that little need be said about the first part of the journey. After the manner almost invariably followed by the drivers of express engines working at high pressures, we make a rapid start over the first mile out of Paddington, leaving the platform at somewhere near the full cut-off of 75 per cent. By Acton or Ealing the engine has been well notched up, to 20 per cent. or even 15 per cent. cut-off, and we accelerate more slowly; but by Southall, or shortly afterward, we cross the "60" line, and on passing Slough we should be not far off 70 miles an hour. The engine can carry on indefinitely at round about 70 miles an hour, even with so substantial a train as this, over the beautifully level line that Brunel has left the Great Western as his most notable legacy. Unless we have experienced signal or permanent way delays, however, too vigorous a progression may carry us more ahead of time than is advisable, and in that event the driver will "ease" the engine, and we shall drop down to 65 miles per hour or so. In the normal course we should get through Slough, 18½ miles from Paddington, in about 21 minutes; Reading, 36 miles, in 37 or 38 minutes; and Didcot, 53 miles out, should be cleared in just about "even time"—that is, 53 minutes from the start.

The tender water supply has been replenished from Goring troughs, between Reading and Didcot. Craning our heads out of the window as we approach Didcot—a most indefensible practice, but we really can't help it in the circumstances!—we see the three Didcot coaches quietly drop off the rear as we dash through the station at 65 miles an hour or more. We notice standing here, too, the train that has left Paddington at 10.45 a.m., which we are booked to pass at Didcot; and we may be sure that the Didcot slip carried at least one or two passengers for Swindon or the Gloucester line who have saved half-an-hour by taking the later train, and overtaking their rightful train in this ingenious way. It is not a "booked" connection, but it is usually "safe" enough to tempt not a few, as it has done me before now when I have been on the way to Swindon.

The gradients, if such they can rightfully be called, now steepen slightly against the engine, although at no point steeper than 1 in 660, which is 8 ft. rising in the mile. This may pull the speed down very slightly, but with our train now reduced to 280 tons, the powerful "King" at the head of it will have no difficulty in keeping the speed just above the mile-a-minute rate. Threading our way at speed through the big yards at Swindon, therefore, we ought to pass there in very little

over 75 minutes from the start. The scheduled passing time is 12.32 p.m., and at exactly the same moment the up two-hour express that leaves Bristol at 11.45 a.m. is also booked to pass Swindon in the opposite direction, with 73 minutes left in which to complete the 77¼ miles to town. That is to say, the combined time of the two trains for a distance of 154½ miles, from Paddington to Swindon and back, is 150 minutes. This is travelling with a vengeance!

The gradient has now turned in favour of the engine, and the speed begins to rise. Sweeping through Wootton Bassett, where the Badminton line leaves us on the right, we reach the crest of the short 1 in 100 descent to Dauntsey at round about 70 miles an hour. A tremendous acceleration should carry us well into the "80's" by the time we pass the latter station, especially if we are running at all late. On one recent trip by this train we were doing 85 miles an hour at Dauntsey, and averaged 75.6 miles an hour over the 16¾ miles from Swindon to Chippenham. From Dauntsey to Corsham the grades are slightly against the engine, and the speed falls gradually until we enter the deep cutting beyond Corsham Station at about 60 miles an hour. The blackness of the Box Tunnel lies immediately ahead.

Photograph] [*Railway Photographs, Liverpool*

"We make a rapid start over the first mile or so out of Paddington." "King" Class 4-6-0 locomotive, No. 6007, "*King William III*," passing West London Junction

In early railway days the Box Tunnel was looked upon as an engineering work of great note, and with its 1⅞ miles of length was considerably the longest railway tunnel of its time. Nowadays there are many other tunnels, chiefly abroad, but some also in this country which outdo the Box Tunnel both in length and also in the overcoming of difficulties to which their present existence bears witness. But scientific knowledge was much more limited when the Box Tunnel was bored, and those who were responsible therefore deserve the more credit for their achievement. As compared with later British tunnels, it is of very large dimensions, which are apparent as you enter it; and a more striking feature, which you will not be able to see, is that for half a mile of its length the line passes through an enormous natural cavern in the freestone, 40 ft. in height and 30 ft. in width, in the shape of a Gothic arch. The Box Tunnel is very noisy, the rails laid in it suffering from that curious phenomenon known as "roaring," generally due to the effect of damp in pitting their running surfaces into minute crests and hollows.

Through the tunnel we are on the second 1 in 100 down-grade, and the speed again rises high, probably well into the "70's," and possibly again above 80 miles an hour, though not often to the latter figure here. We now see the city of Bath ahead, lying in the natural amphitheatre of hills that adds so much to its beauty, and we notice the ornamental stonework that decorates the railway as it is carried through the gardens on the London side of the town. Speed here is drastically reduced, for the line passes through Bath on a sharp curve. Just before reaching the station the guard of the "*Bath Spa*" portion looses off his two coaches, and looking back we see them stop in the centre of the platform on the stroke of one o'clock, or even a shade earlier.

The remaining half-dozen coaches of our train are a plaything for a "King," and 15 minutes is a generous allowance for the last 11½ miles of level track into Bristol. We shall just touch 60 miles an hour or so at Keynsham—we may even get to 70 if the train is late—where the track-troughs at Fox's Wood allow for another re-filling of the tender. There are one or two short tunnels along here, distinguished by the bold architecture of their entrance. At ten minutes past one we should be passing St. Anne's Park, and after passing round sinuous curves through some not very attractive manufacturing outskirts of Bristol, we run slowly into Temple Meads Station at about 1.12 or 1.13 p.m., having maintained an average of exactly 60 miles an hour all the way from Paddington. That is, of course, if we have had no bad delays, and especially outside Temple Meads Station itself, whose traffic has now long outgrown its limited accommodation, so that signal checks in the last mile—notably on summer Saturdays—can be very severe.

We have now four hours in which to amuse ourselves in Bristol. Of the two up two-hour expresses, one left an hour-and-a-half ago, at 11.45 a.m.; but this is the lighter of the two trains, so that it is much preferable that we should wait for the 5.15 p.m. up. Like the train by which we have just come down, the 5.15 carries two slip portions, one for Swindon and the other for Reading, and its timing is made more difficult because it is booked to take the platform road at Reading to detach the latter slip portion, which means a bad slowing and the loss of quite two, if not three minutes in the running. Indeed, the 5.15 p.m. up is without much question the hardest of the four two-hour Bristol expresses, and as it never is allowed any more powerful locomotive than a four-cylinder 4–6–0 "Star," its punctuality record is not so good as that of the other three trains. For some years past, indeed, it has been very seldom that I have recorded an arrival dead on time at Paddington with this train.

We ought to recognise the main portion of the train as it draws into Temple Meads from Weston-super-Mare at 5.2 p.m.—in charge, probably, of a 4–4–2 express tank engine—for it is the "set" in which we travelled down by the 11.15 a.m. from London. At the back of this has been attached a composite coach, and behind that, again, a composite slip brake and a bogie third for Swindon, and another composite slip brake, with probably another third, for Reading. The slip portions are both very popular, and the Swindon one, in particular, makes an important connection there with the through express from Penzance to Aberdeen, which leaves Swindon at 6.20 p.m. Once again, therefore, we have a train of 11 vehicles, whose full weight is very little short of 400 tons, and first-class locomotive work will be necessary if we are to keep time. Not only is the schedule, for the reason already given, the hardest of the four, but the grading, as we shall see in a moment, is considerably harder on the up journey than on the down.

Immediately we leave Temple Meads we diverge to the left from the route by which we entered that station, as though we were travelling to South Wales. This carries us through Stapleton Road—an important Bristol suburban junction—where, before we have attained more than 40 miles an hour, the engine is faced with two miles of climbing past Ashley Hill at the formidable figure of 1 in 75! A nice obstacle in the middle of a run whose average speed is to be all but 59 miles per hour! It will not be at much above 20 miles an hour that we clear the summit of this bank; but in fact, if we were travelling much faster, it would be necessary to slow immediately afterward through Filton Junction, where we diverge to the right from the Bristol to South Wales line. Bearing round to the right, we then join at Stoke Gifford the main line from Paddington to South Wales, over which we travelled by the "*Fishguard Boat Express*" a good many months ago. We are here within 6½ miles of the mouth of the Severn Tunnel, but it does not, of course, lie on our route.

From Stoke Gifford the engine still has rising grades ahead for some 11 miles, the inclination of the ascent being uniformly

"*King George V*," the magnificent 4-cylinder 4–6–0 G.W.R. Passenger Locomotive that created such enthusiasm in America on its visit to the Centenary Celebrations of the Baltimore and Ohio Railroad

1 in 300. We shall forge ahead up this bank, possibly attaining 50 miles an hour, or a trifle over, but more probably maintaining an even rate of about 47 or 48 m.p.h. At Chipping Sodbury we pass over water-troughs, followed at once by the 2½ miles' length of Sodbury Tunnel, under the western spurs of the Cotswold Hills. This brings us to Badminton, the summit of the climb, where we are precisely 100 miles from London. With our heavy train we shall almost certainly have taken 26 to 28 minutes to reach this point, so that we have only from 94 to 92 minutes left in which to complete our last century of miles. But fortunately we have nothing but faintly falling grades or dead level ahead of us.

Through Hullavington and Somerford the line falls at 1 in 300, and provided that the driver has not to refill his boiler after the hard climbing, in which case easier running would be necessary, we shall touch or exceed 75 miles an hour, and may even get to 80 an hour. Then we have to reduce speed slightly over the junction at Wootton Bassett, so that the 40¼ miles to Swindon may be expected to have taken us at least 48 minutes. Here the Swindon "slip" is detached, on the centre road, an engine being ready to draw it to the platform directly we have passed. Seventy-two minutes left for 77¼ miles! Can we do it? With the right driver, yes, most certainly!

Along the faint descent from Shrivenham onward the speed creeps up—Shrivenham, 70; Uffington, 72; Wantage Road, 75; Steventon, 76 or 77, and possibly but only occasionally 80. So we sweep through Didcot and past the Thames Valley stations—Cholsey, Goring, Pangbourne, Tilehurst. Swindon to Didcot, 24¼ miles, 20 minutes; Didcot to Tilehurst, 14¼ miles, 11¾ minutes; this is "going some"! Steam is shut off; we brake down to 30 miles an hour, and roll slowly through the platform road at Reading to drop our second "slip." We have covered the 41¼ miles from Swindon in 35 minutes, and now have 37 minutes for the 36 miles to Paddington—an easy task.

By Twyford we are doing over 65 miles an hour, and from Maidenhead through Slough to West Drayton or Hayes are probably well up in the "70's" again. At Southall we begin to ease, and somewhere about Old Oak Common steam is shut off; so we drift on past Westbourne Park, and, if we are lucky, get through Royal Oak without a signal check. The big arched spans of Paddington roof are in sight ahead, and we roll gently round the curve and stop dead at 7.14 by the clock, a minute early! We have covered the 77¼ miles from Swindon in 71 minutes, and the 100 miles from Badminton in 91½ minutes. This does not happen every day, but we have been fortunate in having one of the best of the Bristol drivers on the footplate. Go and congratulate him; he has given you some of the fastest long-distance railway running in the world.

Just at the time of completing this article, I have received details of some most remarkable runs that have been made in recent months on this 5.15 p.m. up two-hour express, and the Editor tells me that there is just room in which to mention them. The most astonishing was probably a trip on which the two-cylinder 4–6–0 engine "*Saint Bartholomew*" had not only a severe signal delay outside Bristol, but also had to make a special stop at Badminton in order to pick up a distinguished traveller. After doing this, the driver actually succeeded in covering the 100 miles to Paddington, with a slight signal check at Westbourne Park, in 86 minutes, 40 seconds! The 90 miles from Hullavington to Acton were reeled off in 73 minutes, 53 seconds, at an average speed of no less than 73 miles an hour for the whole distance; and this included both the usual slowing over Wootton Bassett Junction and the worse one for slipping the rear coach in Reading platform. A top speed of 80 miles an hour was reached both near Didcot and again on practically dead level track at Slough.

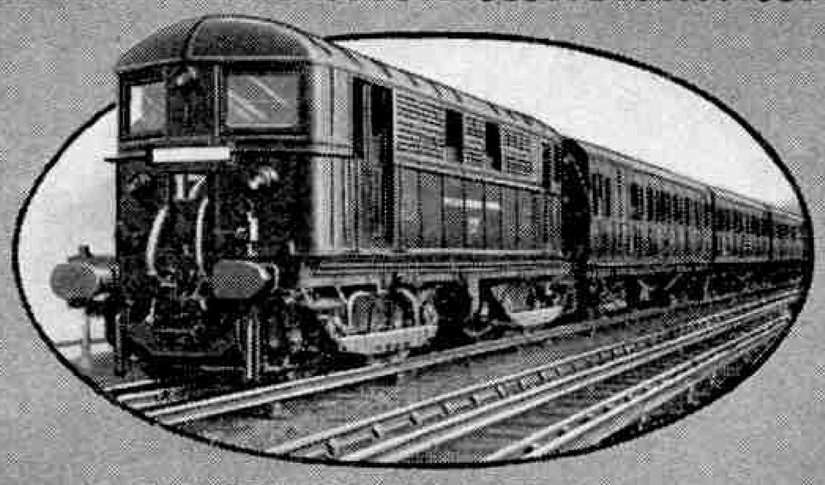
On a second occasion "*St. Andrew*" had to make the same stop at Badminton, and in addition to this, owing to permanent way operations in progress at Reading, was made to stop there to detach the Reading "slip." Yet, after *two dead stops* in what should have been a non-stop run, and bad signal checks between Acton and Paddington, the 117.6 miles from Bristol to Paddington were completed in only 22 seconds over the two hours! The 64 miles from Badminton to Reading were covered in just under 57 minutes, start-to-stop, and the 36 miles from there to Paddington, allowing two minutes for the final delays, in 35½ minutes.

I was fortunate, myself, too, in being on the train when one of the 4-cylinder 4–6–0 engines—"*Italian Monarch*" had the really tremendous load, for this hard train, of 12 big 8-wheelers, weighing all but 400 tons in all out of Bristol. Yet we should have run into Paddington three minutes early but for checks from Old Oak onward, and in this case the 90 miles from Hullavington to Acton took exactly 78 minutes, with an average speed of 69 miles an hour!

Those of you who would like more details of these and other amazingly fast journeys will find them in my June article in the "*Railway Magazine*" on "*British Locomotive Practice and Performance.*"

Below we give the leading dimensions of the "King George V" class

Cylinders (four)	
Diameter	**16½ in.**
Piston stroke	**28 in.**
Wheels	
Bogie, diameter	**3 ft.**
Coupled	**6 ft. 6 in.**
Boiler Pressure	**250 lb. per sq. in.**
Barrel length	**16 ft.**
,, diameter (outside) ...	**6 ft. and 5 ft. 6¼ in.**
Firebox length (outside)	**11 ft. 6 in.**
Heating Surface, total	**2,514 sq. ft.**
Grate Area	**34.3 sq. ft.**
Tractive effort at 85 per cent. B.P. ...	**40,300 lb.**
Weight of Engine in working order ...	**89 tons**
Weight of Tender in working order	**46 tons 14 cwt.**
Total weight	**135 tons 14 cwt.**



A METROPOLITAN TRAIN

RAILWAY NEWS

L.M.S. Locomotive News

As mentioned last month, a number of old L.N.W.R. locomotives bearing similar names to those allotted to some of the "Royal Scot" class engines will probably lose their nameplates shortly. These are "Renown" class 4–4–0 No. 5116, *"Goliath"*; "Precursor" class 4–4–0 No. 5312, *"Velocipede"*; "George the Fifth" class 4–4–0's Nos. 5397, *"Planet,"* and 5398, *"Meteor"*; "Prince of Wales" class 4–6–0's Nos. 5658, *"Atlas"*; 5669, *"Vulcan"*; 5672, *"Condor"*; and 5682, *"Samson."* Nameplates of old L.N.W. 0–6–0T No. 7334, *"Liverpool,"* will probably also be removed. The nameplates of "Experiment" class 4–6–0 No. 5468, *"Lady of the Lake,"* have already been taken off.

Mixed traffic 2–6–0 locomotives Nos. 13100-2 and 13106 have been noted in service on the Highland section.

"Royal Scot" class No. 6118, *"Royal Welch Fusilier,"* was noted in the Liverpool district with the tender of No. 6115, *"Scots Guardsman,"* attached.

The Hunslet Engine Company Ltd. have delivered further 0–6–0 standard shunting tanks, Nos. 16670-4; and Wm. Beardmore and Company Ltd. have delivered Nos. 16730-4 of the same class.

* * * *

The World's Longest Railway

Kowloon, in China, may soon be linked by rail with Calais to make the world's longest railway track. The task of completing the 240 miles of railway on the Canton-Hankow route will take five years to complete.

In 1905 the Peking-Hankow line was completed and later railway tracks were constructed south of Hankow and North of Canton. The final stretch will complete the chain of track from Calais to South China, to make the world's longest railway.

* * * *

The Southern Railway locomotive *"Sir Gillemere,"* No. 783, which drew the train in which Major Segrave travelled from Southampton to London, bore the words *"Welcome Home, Major Segrave."*

"5SW" Heard on a Canadian Train

In his article on the *"International Limited,"* in the *"M.M."* for January last, Mr. C. J. Allen mentioned that the Canadian National Railways have an extensive system of wireless train control, and in addition have a scheme by means of which broadcast programmes are transmitted to passengers in the company's trains. In this connection it is interesting to learn that a C.N.R. train travelling between Sioux Lookout and Redditt, Ont., 1,219 miles east of Montreal, recently picked up Chelmsford, England, with a specially installed receiving set, and passengers were able to enjoy the programme for a quarter of an hour. It is said that the C.N.R, intend to make a special feature of British programmes.

* * * *

The "Cornish Riviera's" 25th Birthday

The world-famous Great Western Railway 10.30 a.m. *"Cornish Riviera Express"* celebrates its 25th anniversary this year, and to mark the occasion the Company are now building at their Swindon works passenger coaches embodying all the latest in railway rolling stock design for use on the train. These coaches will be wider than the ordinary stock. Luxurious restaurant cars will be included in the formation of the train which, since it commenced running in 1904, has carried millions of visitors to Devon and Cornwall.

* * * *

L.N.E.R. Locomotives, 2755, *"Berkshire"*; 2756, *"Selkirkshire"*; 2757, *"Dumfriesshire,"* have been seen working near Glasgow.

"Grand National" Special Working

In connection with the races at Aintree in March last, an extensive service of special trains was worked to and from Aintree Station, C.L.C. from various parts of the L.N.E. systems. For nearly three hours after the race had finished the specials were despatched from Aintree Station at almost regular intervals of five minutes, and all credit is due to the station staff at Aintree for the way in which their work was carried out.

L.M.S. "Midland Section" locomotives noted on the L.M.S. race specials were two-cylinder 4–4–0's Nos. 406, 417, 421, 490, 494, 499, 515, 535 and 558. Most of the L.M.S. expresses were double-headed, the train engines in five cases being compound locomotives Nos. 1035, 1061, 1090, 1097 and 1103. The London Film Special was worked by 4–4–0 No. 515.

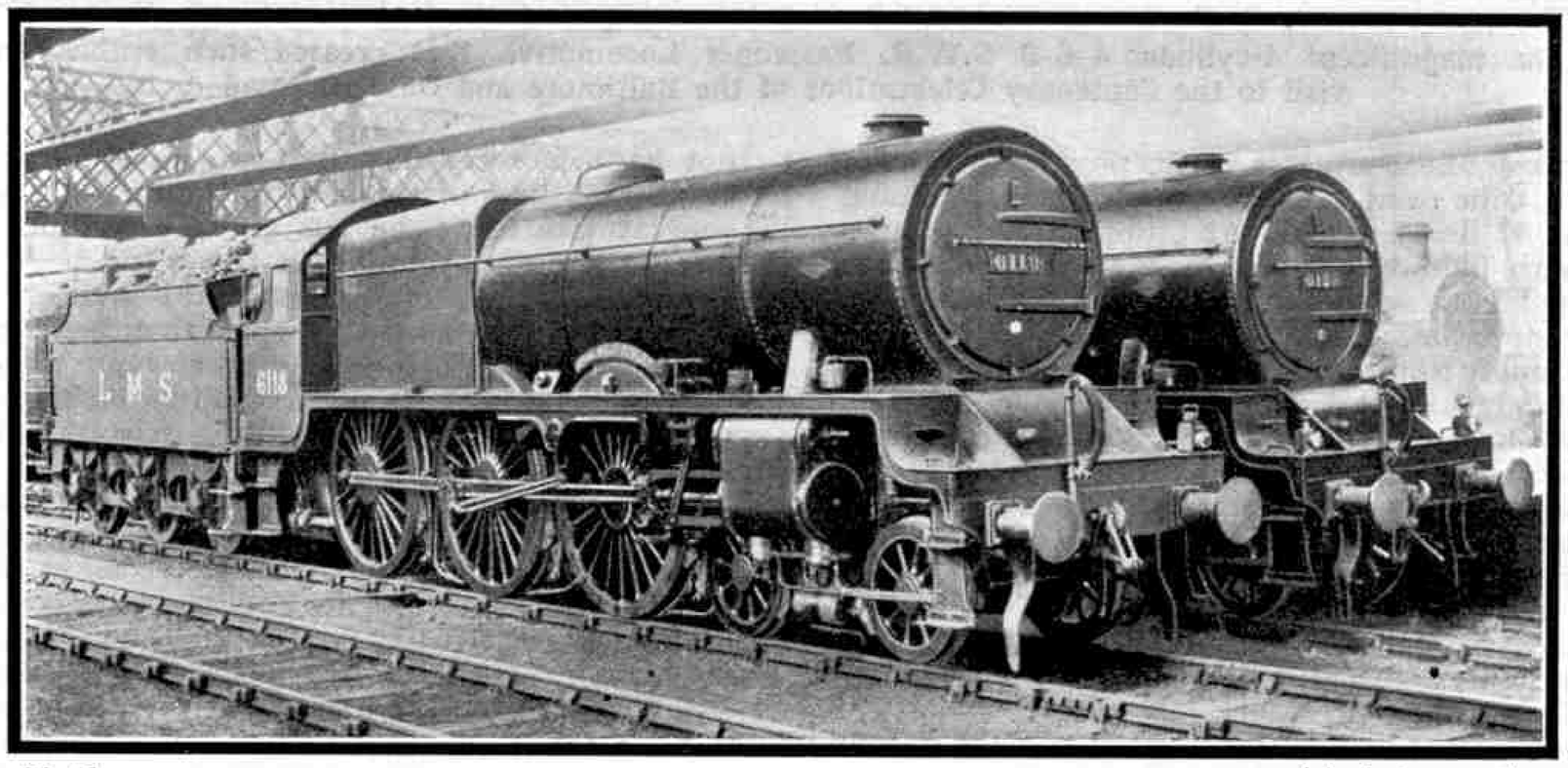
Locomotives in charge of the L.N.E.R. specials in and out of Aintree included Gresley Pacific No. 2561, *"Minoru,"* on the "Pullman Car Race Special" from King's Cross. The Great Central Section was represented by the War Memorial engine No. 6165, *"Valour,"* and other Great Central section engines seen were mixed traffic 4–6–0's Nos. 5031, 5036, 5053, 5078, 5469, 5470, 5476, 5477, 5482, 6069 and 4–4–0 No. 6038.

Small Pollitt 4–4–0 locomotive No. 5853 worked the "Daily Mail" special (with photographs, etc., of the race) through to Manchester. The special consisted of two coaches only. G.N. Section 2–6–0 locomotives Nos. 58 and 204, and G.E. Section "1500" class 4–6–0, No. 8563, also worked special race trains over the week-end.

* * * *

New Sleeping Coaches

A new type of sleeping car divided into compartments each containing single beds has been introduced on the Montreal-Toronto line of the Canadian National Railways. These new compartments are to be called *"Chambrettes"* in order to distinguish them from the standard type of sleeping compartments.



Photo] [*J. J. Cunningham*

L.M.S. "Royal Scot" class 4-6-0's, 6118, *"Royal Welch Fusilier"* and 6123, *"Royal Irish Fusilier,"* side by side in Carlisle Station

L.N.E.R. Locomotive News

Six of the new "Shire" class 3-cylinder locomotives have been fitted with Lentz valves. These valves are operated by the well-knownGresley-Walschaerts motion, similar to that used on the famous "Pacifics." Two engines of the "Shire" class have been fitted with a special rotary valve gear—Nos. 336, *"Buckinghamshire"*; and 352, *"Leicestershire."*

The following creditable run has been made by a G.E. Section "1500" class locomotive, No. 8538, on the 7.25 a.m. ex Parkstone to Manchester express. The train was composed of 11 bogie coaches from Ipswich to March; nine bogie coaches from March to Lincoln, and seven bogie coaches from Lincoln to Manchester. On account of brake trouble the original engine was taken off the train at Ipswich, and No. 8538 was put in charge at this point. The train left 31 minutes late, but arrived in Manchester exactly on time.

R. & W. Hawthorne, Leslie & Co. Ltd. have delivered three new "N2" class 0–6–2 tank engines, Nos. 2673-5.

Six Sentinel Cammell cars are working in the Scottish area—31, *"Flower of Yarrow"*; 32, *"Fair Maid"*; 33, *"Highland Chieftain"*; 34, *"Tweedside"*; 35, *"Nettle,"* and 36, *"Royal Eagle."* Several of these have been put into service in the neighbourhood of Edinburgh, Stirling, Aberdeen and Carlisle, with very satisfactory results.

Dimensions of the new series "Felstead" Pacifics were given in our *"Railway News"* last December. We now publish a complete list of names and numbers of these engines:—2743, *"Felstead"*; 2744, *"Grand Parade"*; 2745, *"Captain Cuttle"*; 2746, *"Fairway"*; 2747, *"Coronach"*; 2748, *"Colorado"*; 2749, *"Flamingo"*; 2750, *"Papyrus"*; 2751, *"Humorist"*; 2752, *"Spion Kop."*

* * * *

Locomotive Framework Cast in One Piece

We understand that arrangements have been made by the Canadian Locomotive Works at Kingston, Ont., to cast in a single piece, weighing about 50,000 lb., the entire framework of each of five new locomotives for the Canadian National Railways. It is said that the absence of nuts and bolts from the frames will result in a saving in weight of not less than 1,000 lb. per locomotive.

* * * *

The Pope's Railway

In connection with the new Papal State the construction of the railway station inside the Vatican gardens at Rome will be started immediately. It will consist of a covered gallery large enough for the Papal train, and also a goods siding.

Marshalling Yards at March

The large marshalling yard of the London and North-Eastern Railway at Whitemoor, near March, is now nearing completion, and a large portion of it was brought into operation quite recently. It lies in the angle between the Doncaster and Wisbech lines, and is entered by facing points off the "up" Doncaster line, where arriving trains are at once received in one of the ten reception roads, each of which holds eighty goods wagons. South of these roads is the hump for gravitational shunting, the descending side of which is laid on a gradient of 1 in 18. The wagons of arriving trains are sorted there into four groups of sidings; ten sidings are in each group, and they have accommodation for 3,679 wagons.

Hydraulically-operated retarders are provided immediately inside each group to check the speed of the wagons coming down from the hump, and the points for entering the groups and the sidings are operated electrically. The newly-formed trains that are made up in the sidings leave by one or other of the two departure roads, which join the Wisbech line at a point just north of the junction between the Doncaster and Wisbech lines. Floodlighting is employed at night for shunting operations.

* * * *

The *"Lion,"* a veteran locomotive of the old Liverpool and Manchester Railway, was recently taken from Liverpool to Crewe to be reconditioned before being placed in retirement. We hope shortly to publish photographs and particulars of this interesting old locomotive.

L.M.S. "Prince of Wales" class 4-6-0 No. 5640, "*General Joffre*" on a Manchester (London Road) to Liverpool (Lime Street) Express approaching Mossley Hill

Proposed Underground Railway System for Montreal

The official *"Canadian Gazette"* publishes a notice of an application to the Dominion Parliament that is of considerable interest. The application is for the passing of an Act authorising the construction by the "Montreal Underground Terminal Company" of subways and tunnels for railways in the city of Montreal, in conjunction with the main line railways on the island of Montreal.

The plan has been prepared by Mr. S. Ouimet, a Montreal civil engineer. According to Montreal newspapers, the project contemplates the construction of an underground central terminal providing for all incoming railways, with provision for a focal point for the street railway system. One of the advantages claimed by the designer is that all level crossings within the city limits would be abolished.

* * *

G.W.R. Locomotive News

New engines that have been received from the North British Locomotive Co. Ltd., of Glasgow, include 0–6–0 Tank locomotives Nos. 5700-7, and Nos. 5726-9 of the same type. Tank goods 2–6–2 locomotives Nos. 5565-9 have been turned out of the Swindon Works.

The following is a complete list of names and numbers of "King" class locomotives: 6000, *"King George V"*; 6001, *"King Edward VII"*; 6002, *"King William IV"*; 6003, *"King George IV"*; 6004, *"King George III"*; 6005, *"King George II"*; 6006, *"King George I"*; 6007, *"King William III"*; 6008, *"King James II"*; 6009, *"King Charles II"*; 6010, *"King Charles I"*; 6011, *"King James I"*; 6012, *"King Edward VI"*; 6013, *"King Henry VIII"*; 6014, *"King Henry VII"*; 6015, *"King Richard III"*; 6016, *"King Edward V"*; 6017, *"King Edward IV"*; 6018, *"King Henry VI"*; 6019, *"King Henry V."*

DIFFICULTIES EXPLAINED

IX—Red Bands on Mile Posts

On certain of the mile posts located along the London & South Western Section of the Southern Railway there are painted red bands. These bands indicate division points for the permanent way gangs responsible for the maintenance of the track.

* * * *

Reconstruction of Retford Road Bridge, Woodhouse

The reconstruction of the bridge carrying the Manchester to London main line over the Retford Road, near Woodhouse, 6 miles east of Sheffield, has just been completed. The work was necessitated by the widening of the road.

Four lines of way are carried on the bridge, which formerly consisted of a single span of 36 ft. As reconstructed, it has three spans—a centre roadway opening of 40 ft. and two footpath openings of 15 ft.

The superstructure is of steelwork, and in four independent sections.

World's Largest Oil-Electric Locomotive

A 2,660-h.p. Monster for the C.N.R.

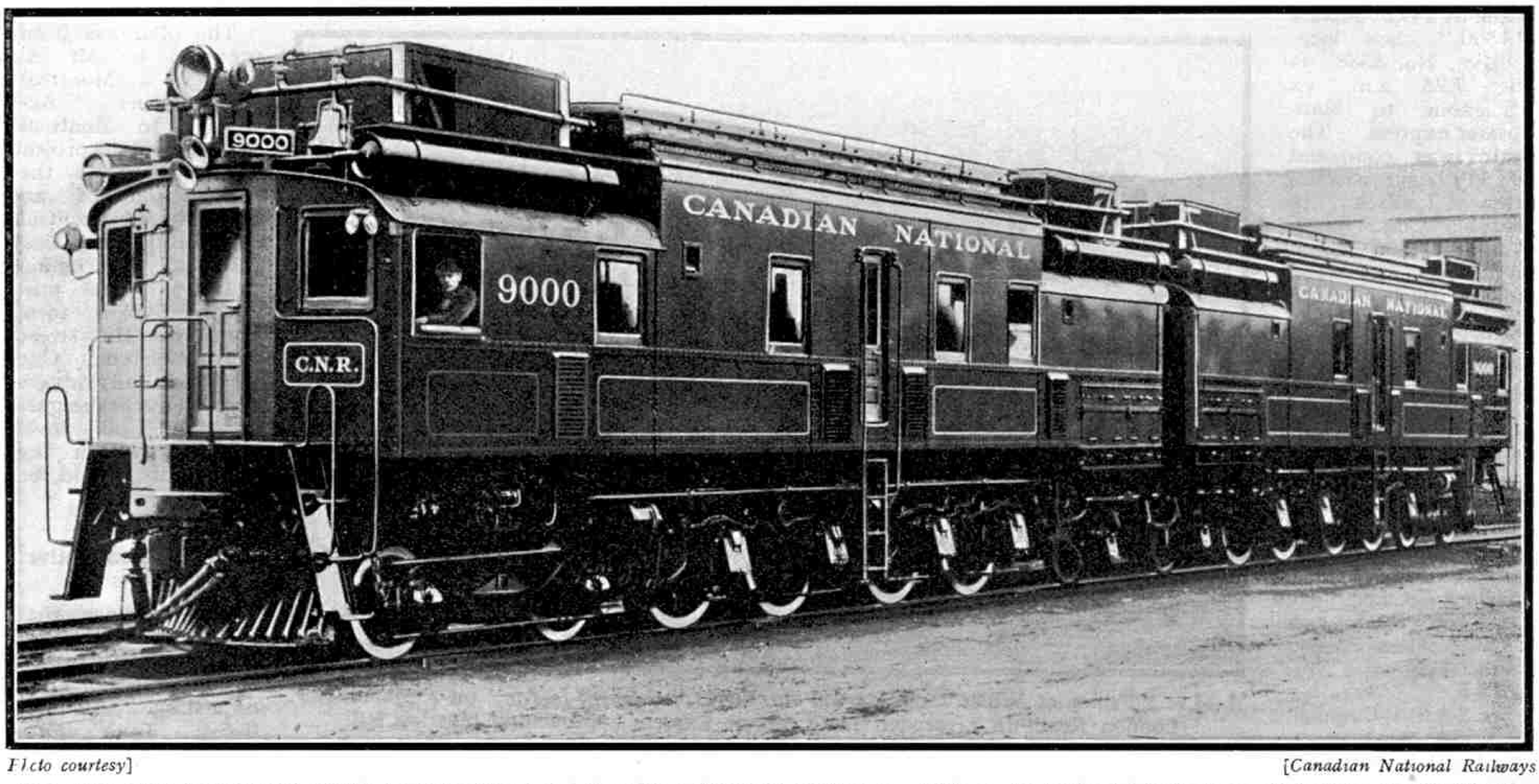


Photo courtesy] [Canadian National Railways

The New Oil-Electric Locomotive introduced by the Canadian National Railways. This is the largest Locomotive of its type in the World, weighs over 290 tons and generates 2,660 h.p.

THE Canadian National Railways have placed in operation on their lines between Brockville and Belleville, Ontario, a 2,660-h.p. oil-electric locomotive. This locomotive is the largest and the most powerful of its kind in the world, and its engines have been designed and supplied by William Beardmore & Co. Ltd., of Glasgow.

This locomotive consists of two units weighing together a little over 290 tons when fully equipped, of which 214 tons are carried on the driving wheels. Each unit consists essentially of an oil engine generator set mounted on the locomotive frame; boiler equipment for steam heating of passenger coaches; four traction motors for propelling the locomotive, and air brake and other auxiliary equipment.

The power developed by the oil engine is converted into electrical energy by the generator and transmitted to the traction motors geared to the driving axles, where it is utilised in developing tractive effort and speed. With the present gear ratio, which was laid out for high-speed passenger service, the locomotive will develop a tractive effort of 100,000 lb. during accelerating periods and 42,000 lb. continuously. The electrical system of transmission utilises full engine horse power over a wide range of speed and tractive effort of the locomotive, without change of engine speed or shifting of gears. It also provides a quick and easy method for reversing the locomotive without stopping or reversing the oil engine.

The operation of the locomotive and the speed of the oil engine are controlled from either of two enginemen's stations, which are located in separate compartments at the outer end of each unit. Means are provided for the control of both units jointly, or either unit independently of the other, from these stations. Gauges are mounted at each station for indicating the operation of each unit.

Each unit contains a Beardmore 12-cylinder oil engine of the solid injection type, 12 in. bore and 12 in. stroke. The engine has a nominal rating of 1,330 h.p. at 800 r.p.m. It is of the variable speed type, and may be run at any speed between idling speed at 300 r.p.m. and full speed at 800 r.p.m., the engine governor controlling the throttle to maintain the speed corresponding to the governor setting. A fractional h.p. electric motor is used for changing the speed setting of the governor. The engine develops its rated horse power at a fuel rate of 0.43 lb. per brake horse-power-hour. It is started up from a storage battery on the locomotive, the main generator being used to crank it over.

The cooling of the oil engine is accomplished by circulating the engine jacket water through radiators of the honeycomb type mounted on the locomotive roof. The lubricating oil is circulated through tubular finned type radiators, which are also mounted on the roof. Both sets of radiators are force-ventilated by motor-driven blowers of the propeller type, although the natural ventilation resulting from the locomotive speed will be sufficient to cool the engine during cold weather, and will be of material assistance in cooling it at

other times, even during the hottest Canadian summer.

The engine exhaust is carried to an exhaust boiler of the thimble tube type supplied by Clarkson Steam Motors Company Limited, London. This firm supplied also a separate auxiliary oil-fired boiler of the same type. Automatic control of water injection pumps is provided to maintain the water at constant level in both boilers. These boilers supply steam for heating and when there is no demand for steam the exhaust boiler is operated dry as a silencer for the oil engine, and at the same time the oil-fired boiler is cut out.

The system of control provides for varying the speed of the oil engine, the generator voltage, and shunting the field of the series traction motors for changing the speed of the locomotive. A torque governor operates automatically to prevent overloading the engine. A system of remote control of generator and motor switches and of speed setting of the engine governor permits the multiple operation of the two units comprising the locomotive. Automatic reversal of radiator blowers occurs with reversal of the locomotive in order to maintain the flow of the cooling air in such a direction that the blowers assist the natural flow of air due to the pressure developed by the direction of travel of the locomotive. A motor-driven blower is installed in each cab for force-ventilating the traction motors when conditions warrant in passenger service, and when in freight service. The locomotive is fitted with Westinghouse type air brake equipment. Four "driver" brake cylinders are provided for each unit, two of which brake the two forward pairs of drivers while the other two brake the two rear pairs. A fifth brake cylinder is provided for braking the four-wheeled engine truck. There is also a hand brake for holding the locomotive when stopped, in case the air brake should be inoperative at the time.

A lead storage battery of 56 cells is carried on each unit. This battery is installed primarily for engine starting, but it also furnishes part-time power for control, lights and auxiliaries.

The mechanical design of the locomotive is the result of the combined efforts of the Canadian National Railways, Canadian Locomotive Company, Baldwin Locomotive Works, Commonwealth Steel Company and Westinghouse Electric and Manufacturing Company.

Each unit carries approximately 8,000 lb. of fuel oil, 11,000 lb. of boiler water, 3,000 lb. of engine jacket cooling water, 3,000 lb. of sand and 1,000 lb. of engine lubricating oil. The supply of fuel oil will be sufficient for operation of oil engine and oil-fired boiler, under average conditions, for 12 hours. A motor-driven pump is mounted on each unit for filling fuel oil tanks, and an oil filling pipe is installed on the locomotive for filling either unit from a tank car at the end of the locomotive The supply of boiler water will be sufficient for heating a train of average length for periods of from six to twelve hours, depending upon the outside temperature.

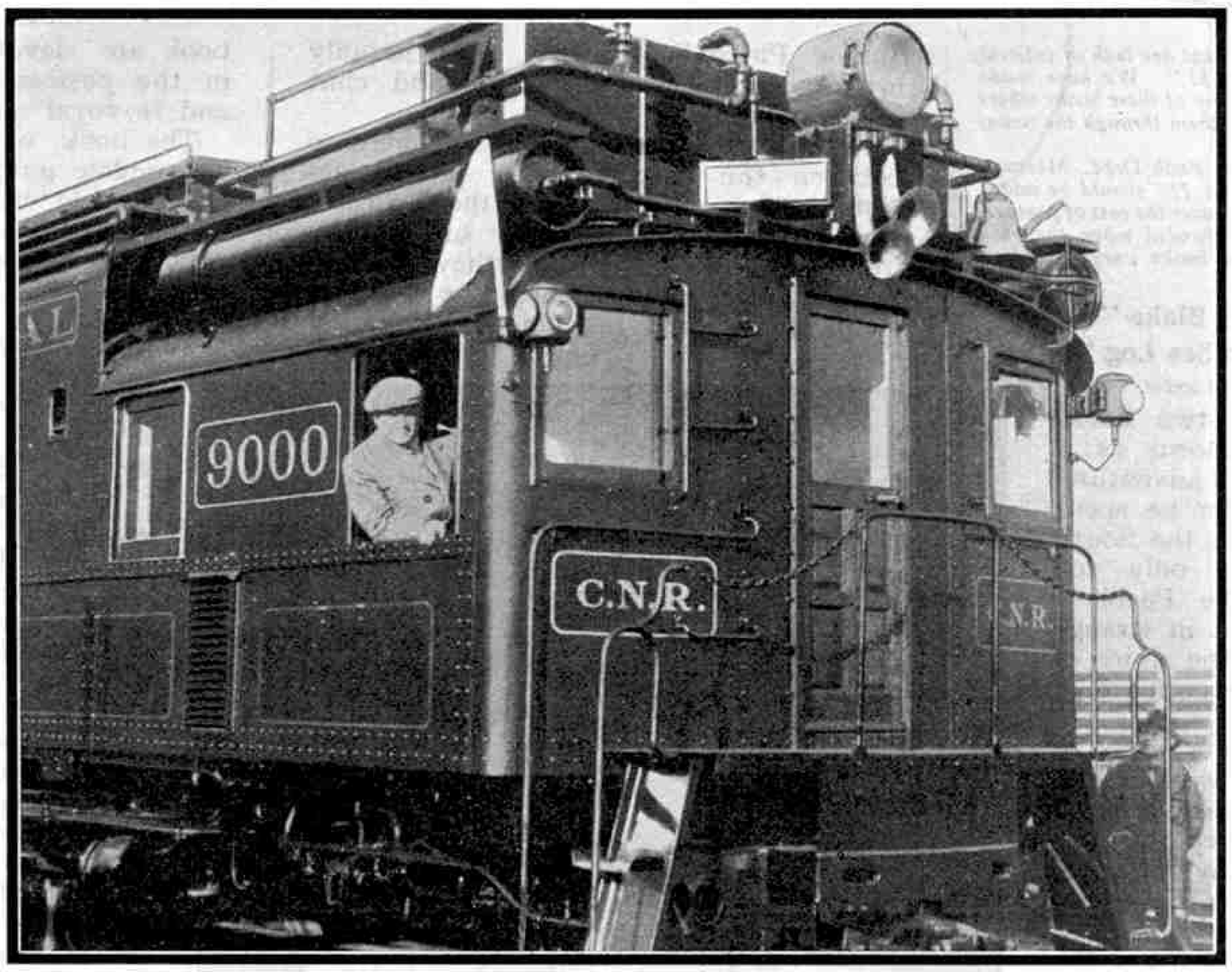


Photo courtesy] [*Canadian National Railways*

One of the cabs of the new C.N.R. Locomotive. Its massive proportions may be appreciated by comparing it with the man on the right of photograph

The traction motors are geared for high-speed passenger service and the locomotive will handle the heaviest passenger train at a high schedule speed. Even with this gear ratio the locomotive is capable of hauling a train of 2,800 tons at 19 m.p.h. on a 0.4 per cent. grade, or at 40 m.p.h. on the level. If a freight gear ratio of 18 : 73 were to be adopted, the locomotive would be capable of handling a trailing load of 3,700 tons at approximately 15 m.p.h. on a grade of 0.4 per cent., or 35 m.p.h. on level track.

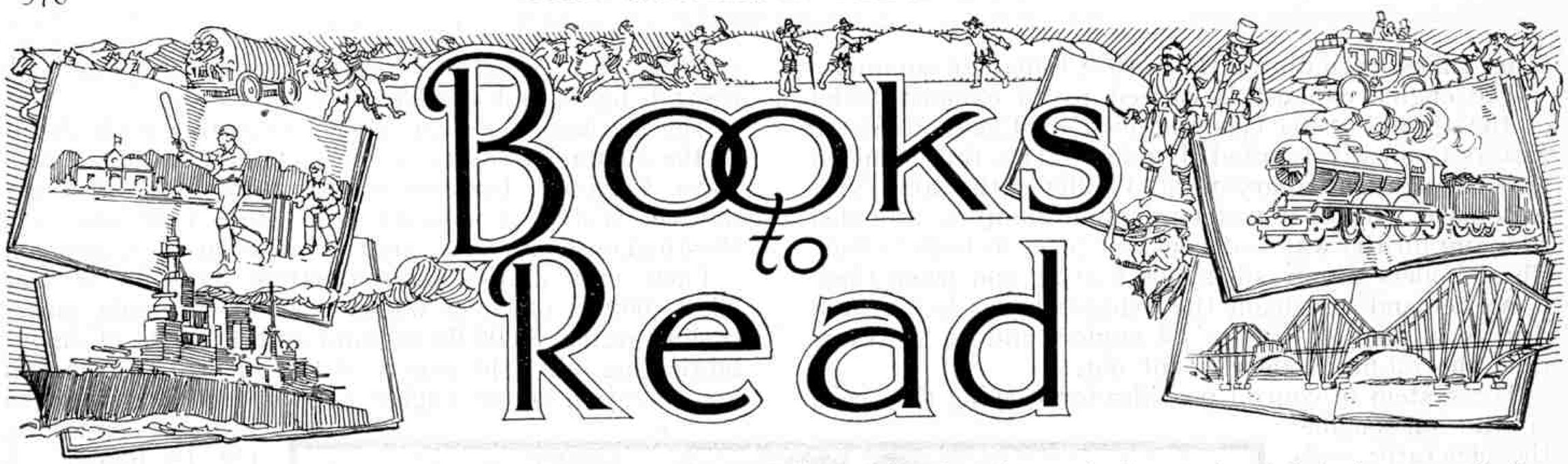
An interesting feature of the locomotive is that the oil engines of both units are arranged for future application of superchargers, one of which has already been built and tested on both engines. The effectiveness of superchargers has been proved in the case of such racing motor cars as Major Segrave's "*Golden Arrow*," and their use would result in a considerable increase in the power of the locomotive.

Largest Animal Ever Known

The members of an American exploring expedition that visited Central Asia have discovered fossilised remains of portions of the skeleton of the largest animal that ever existed. These show that the height of this freak of nature was 25 ft. and that its length was in proportion. The animal must have weighed at least 20 tons, and thus was twice as heavy as the famous circus elephant "*Jumbo*," whose name is now applied almost in derision to any living thing that is large and unwieldy.

With memories of the Woolworth Building in their minds, the discoverers of the bones nicknamed the now extinct animal "*Woolworth!*" It has the proud distinction of having regained supremacy in point of size for the mammals—the class of animals to which human beings belong—for previously it had been believed that the great antediluvian reptiles called dinosaurs were the largest creatures that ever walked the earth.

The monster whose existence has now been revealed must have presented a formidable appearance. The length of its lower jaw was greater than the height of a human being, and some of its teeth were more than a yard in length and 7 in. in width. The bone between the elbow and the shoulder was 4 ft. in length and as far round as a man's body. In all probability it was not a dangerous enemy, however. Like most of the huge animals of the past and of the present, its body became too great for its brain, and it became extinct because it was too huge to be of any earthly use.



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Adventures of Louis Blake"
"Notes from My South Sea Log"

By Louis Becke (T. Werner Laurie. 5/-)

The author of these two books of short stories, well-known as a writer of South Sea tales of adventure, writes from first hand for he spent some considerable time in the South Seas. Mr. Becke knew only too well the romance of the Pacific—among the islands, at sea in strange schooners, or loafing in the slums of the ports—for he had experience of all its phases.

The books are two of a series of Mr. Becke's collected works, and consist of short stories gleaned from the log books he kept when he sailed those romantic waters many years ago. His first story in "*Notes From My South Sea Log*" is entitled "*Bay o' Fundy Days*," and it describes the author's boyhood on a part of the Australian coast, where as a boy he groped upon a reef for aliotis shells when the tide was low.

The South Sea Islands have changed greatly in the last thirty years, for missionaries and steamships have made them a very different place from the days of old. These changes took place after Mr. Becke's time, however, and our author paints the islands as they were in the days of romance, when the seas were not policed as they are to-day. All his stories are so well-written that we can almost hear the surf beating on the sunny coral. He shows us many pictures of himself, and in them we easily recognise the supremely happy man, sitting in a little boat in the bluest of blue water, pulling up wonderful fishes from the depths of the lagoon. In the midst of our busy lives, such tales are refreshing, and they are a delight to those men and boys who are not so fortunate as to be able to live in the sunny climes of the Pacific.

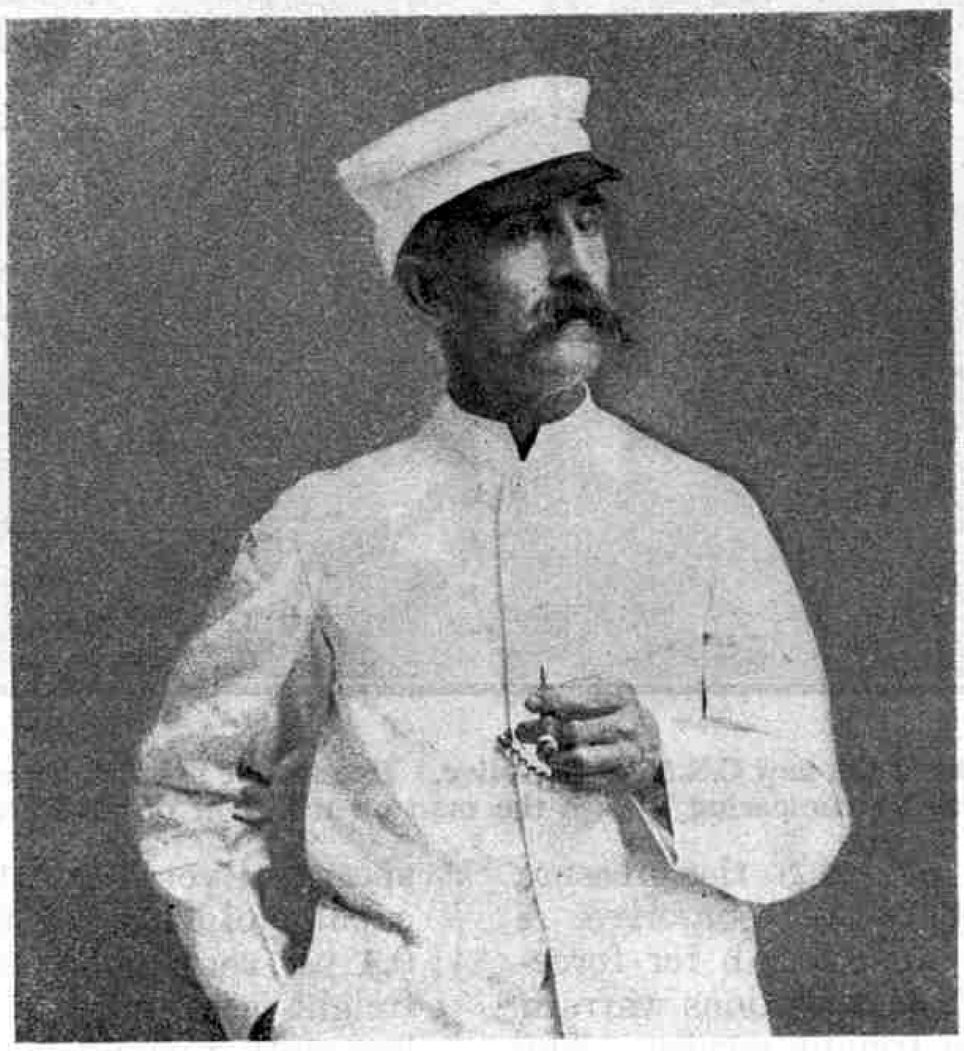
* * * *

"Chats on Postage Stamps"

By F. J. Melville (Ernest Benn Ltd. 10/6)

This volume is one of the familiar "Chats Series" of practical handbooks for collectors, which have for their aim practicable guidance in the hobbies dealt with. In this particular volume there could be no better authority to guide us than Mr. Melville, the President of the Junior Philatelic Society, who happily invites the reader to "come and chat in my stamp-den."

From his preface we learn the difference between the collector who merely accumulates specimens, and the collector who uses his eyes to study his stamps, from which he extracts all they have to teach. He reads into them the development of arts and manufactures; social, commercial and political progress; and the rise and fall of nations.



Louis Becke, the Author of the two books reviewed in the first column on this page

Mr. Neville, has endeavoured to indicate "what counts" in modern stamp-collecting, and it is interesting to know that he places great value on a stamp collection in which pairs and blocks of stamps are featured. The book tells us of many interesting matters connected with stamps—particularly, the story of the post, from the time of the earliest letter-carriers to the time of the Romans, and on then through the ages until the introduction of uniform penny postage. It may surprise readers to know that there was a "penny post" as early as 1680. In other chapters we learn how the idea of postage stamps developed, and we are given an account of some of the early pioneers of stamp collecting. Following this are chapters on forming a collection; the scope of a modern collection; stamp-collecting as an investment; and forgeries and fakes. The last two chapters of the book are devoted to famous collections in the possession of private individuals and in royal and national possession.

The book, which is not intended to be a complete guide to the postage stamps of the world, but is rather to be regarded as a companion volume to the standard catalogues already available, is beautifully illustrated with numbers of plates. It will form a valuable addition to the library of every serious stamp-collector.

* * * *

"The Ant People"

By H. H. Ewers (The Bodley Head. 8/6)

As everyone knows, ants are wonderful insects. From this book we learn that they have so many of the virtues and vices of human beings that it is quite easy to fall into the author's manner of regarding them as "people."

Most of us know very little about ants, although they are the commonest of insects. Perhaps the reason for our lack of knowledge is that most of the books about ants are not written so that ordinary people can understand them, but are full of lengthy scientific words that make the reading of them more like work than pleasure! In this book, however, the subject is treated in a more popular way, and the story holds our interest throughout.

Dr. Ewers has travelled in all parts of the world, and—as he says in his own inimitable style—he "has poked his nose into ant nests in every land!" He has fought the Fire Ants of Texas; studied the Common Red Ants of Georgia; faced the Wandering Ants of Mexico, and has been bitten by the Bull Dog Ants of Australia. In his book he shows us ants from every possible point of view, and gives us as complete and as varied a story of the life of these creatures as it is possible to contain in a single volume.

With some amount of consternation we find that many of our ideas about ants turn out to be false. The old saying "Go to the Ant, thou sluggard!" cannot altogether be truthfully applied, for we find that ants are not as industrious as we had been taught to believe. Actually there are many species that never work at all, and others that live by fighting as did the robber barons of the Middle Ages! All this, and much more, will be discovered in this fascinating book, which will appeal to all interested in Nature study in general and insects in particular.

We have only one adverse comment—the book would have been even more interesting if it had been illustrated.

"Bells through the Ages"

By J. R. NICHOLLS (Chapman & Hall. 21/-)

This book, dealing with "the Founder's craft and Ringer's art," is an interesting account of the science and art of casting and ringing bells, known as campanology. The book includes such chapters as Founding, Tuning and Hanging; Bell Decoration; Inscription on Bells; Dedication of Bells; Chimes and Mechanical Appliances; Carillons; Lost Bells; and the Lore and Legends connected with the subject.

Bells are associated throughout with human life, from the earliest days when they call us to school and to church, until they perform their last office when they toll at our funeral. It is only natural, therefore, that there should be a great amount of interest in them, and it is believed that there are over 40,000 bellringers in England alone. It is not long since some 2,400 of these bellringers from all parts of the country visited Croydon to hear the largest bell ever cast in Britain.

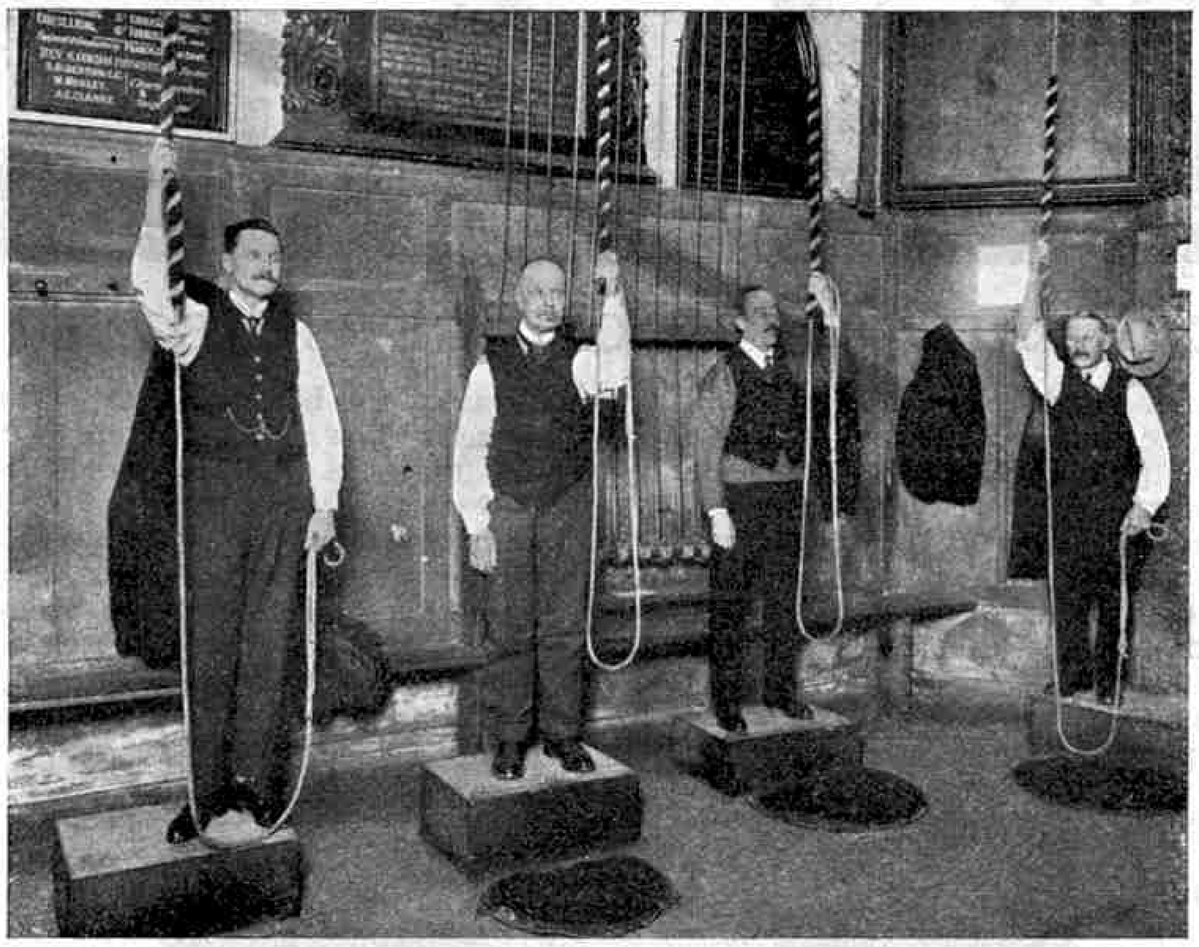
The art of bell making and bell ringing has existed certainly for many thousands of years. The art is so ancient, indeed, that we do not know who made the first bell, but whoever it was he lived long before the Pharaohs. Even if records did exist it would be difficult to determine the dividing line between the pieces of wood, stone, or metal that served as tocsins, and the first real bell.

Bells were hung in the turrets of the churches of 1,300 years ago, and the use of "rings" in more or less musical sequence was well established in the 11th century. The earliest dated bell in England (one at Claughton in Lancashire) dates from 1296. The only great bell dating from the Middle Ages in this country is "Great Peter" of Gloucester, which was cast nearly 500 years ago and was rung by eight men until 1827.

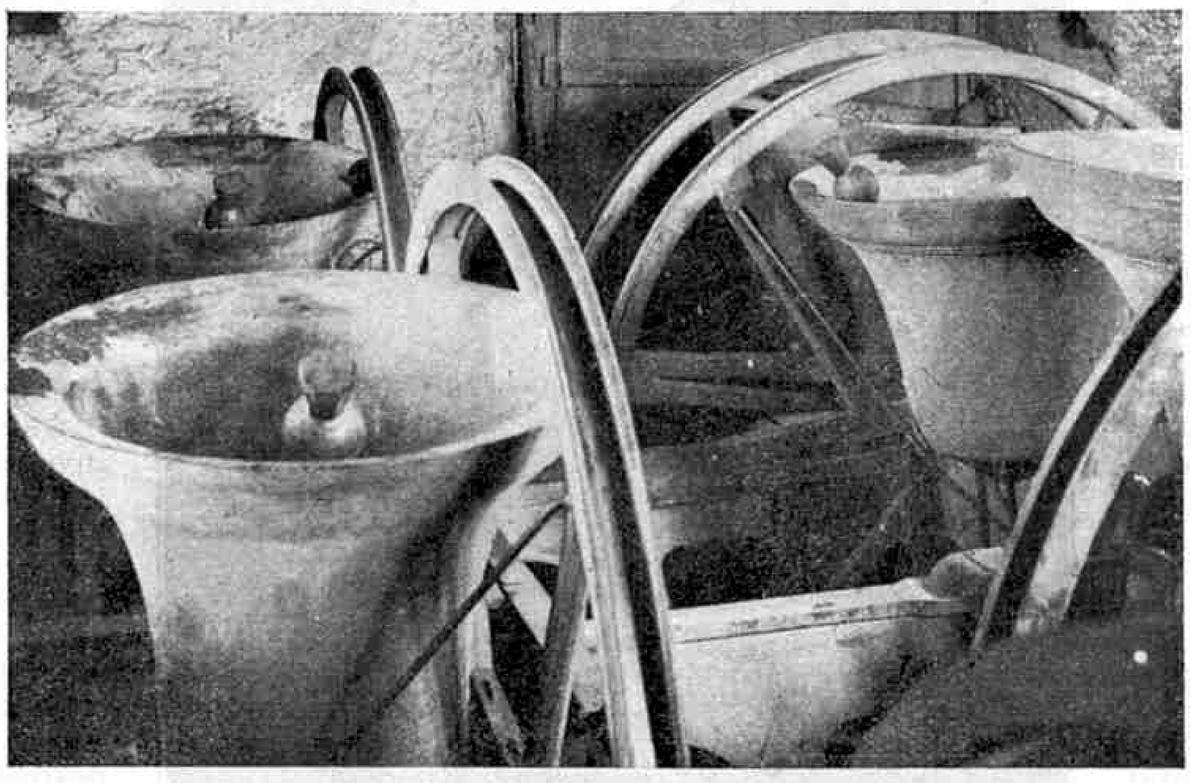
Among the largest bells in the world is a 90-ton bell in a Burmese pagoda, but one that is even larger than this is the great "Tzar Kolokol" of the Kremlin, which weighs nearly 300 tons. This and other large bells were too heavy to be hung in the ordinary manner, but were sounded by pulling the clapper to the bell. It is interesting to know that the largest ringable bell in the world is "Great Paul" in St. Paul's Cathedral, and Mr. Nicholls claims that it is only by ringing in the English manner that the full sonorous tone of the bell is obtained.

In addition to being lost through ordinary wear and tear, many bells have been lost by confiscation on account of their having been used for disloyal purposes. Many bells in Cornwall and Devon were lost from this cause, through their having been used to summon together the insurgents at the time of Arundel's Rebellion. Then again, bells have frequently been taken as spoils of war, and in most of these cases they have been broken up and converted into cannon. During the Moorish occupation of Spain, for instance, the bells of the Cathedral at Santiago were conveyed to Cordova on the shoulders of Christian captives. In 1235, the pendulum swung in the other direction when these bells were restored by Ferdinand III, and this time were sent back on the shoulders of Moorish prisoners.

A number of bells were taken by the British Fleet during the Crimean War. The bell of Bomarsund in the Aland Islands, taken in 1854, was kept in the Tower of London until 1925, when it was returned. Another bell, taken from the fortified Monastery of Solavatski by a landing party from the British squadron, eventually found its way to a Portsmouth church, but was restored to the monks of Solavatski in 1913. A bell taken from Calais by Henry V is said to be hanging to-day in the steeple of his native town of Monmouth, and it would be interesting to learn if any of our Monmouth readers can give us any information about it.



A corner of the ringing chamber at St. Mary-le-Bow, London



The Bell Chamber, St. Andrews, Plymouth. This and the above illustration are from "Bells Through the Ages" reviewed on this page

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"Locomotive Engineers' Pocket-Book, 1929"

(The Locomotive Publishing Co. 3/6)

This is a pocket-book that will be particularly useful to all mechanically-minded readers, and especially to those interested in railway engineering. Its 377 pages of valuable information include tables, statistics and drawings concerned with locomotive engineering. There are also details of such important matters as gauges, locomotive power, boilers, fuels, horse-power rating, steam consumption, adhesion, wheel arrangements, link motion, valve gears, locomotive performances, etc. The book will be of considerable interest and value for reference purposes.

* * * *

"The Wonder Book of Pets"

(Published by Ward Lock & Co. Ltd. 6/-)

Nearly every boy and girl has a pet of some kind and from these pets much pleasure is derived. A certain amount of knowledge is necessary for the care of pets and animals, however, and in this beautifully-illustrated volume there are many practical hints by experts as to the wants and natural ways of life of all kinds of pets.

We are told how to prepare for our pet, given housing and management hints and also hints on feeding; how to choose a dog; grooming, feeding and treatment in illness. Cats, rabbits and guinea-pigs are also dealt with in the articles, as well as many wild creatures such as birds, hedge-hogs, etc. There are some useful hints on keeping an aquarium with gold-fish and other water pets. Reptiles, tortoises, silkworms and pigeons are not forgotten—indeed, there is mentioned almost every creature that can be kept in this country.

Hundreds of pictures and twelve fine coloured plates add to the charm of the book, which to everyone fond of animals—whether or not they have pets of their own—will be a volume of the greatest interest.

Interesting New Books

We hope to deal with the undermentioned books in an early issue.

"THE SOUTH POLAR TRAIL"
by ERNEST MILLS JOYCE. (Duckworth. 10/6)

"BEYOND THE ROCKIES"
by LUKIN JOHNSTON. (Dent. 10/6)

"ICE BOUND"
by JAMES ASHTON. (Putnam. 15/-)

"MOUNTAIN GOLD AND CANNIBALS"
by DORIS R. BOOTH. (Cecil Palmer. 7/6)

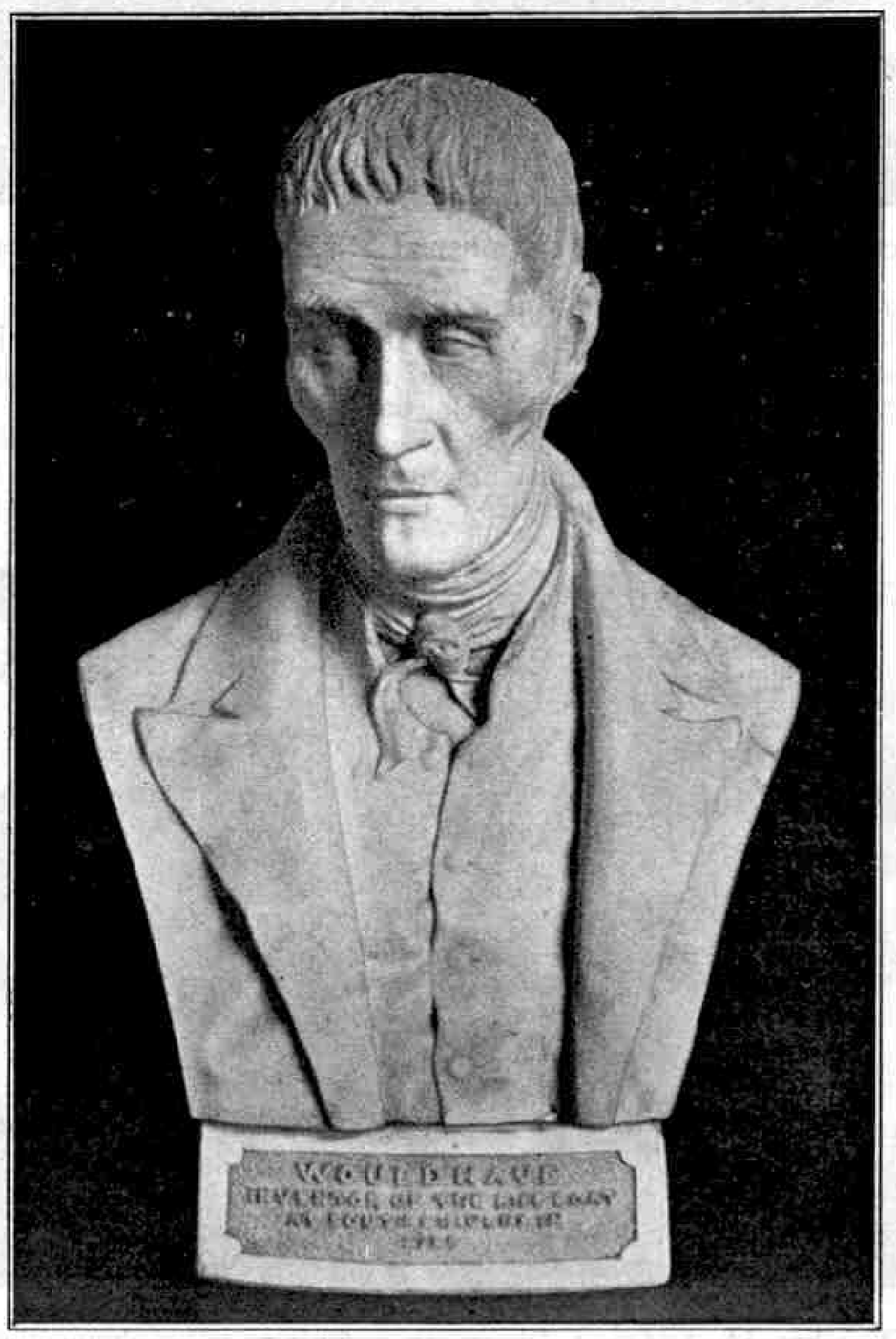
"GLIMPSES OF SOUTH AFRICA"
by NOEL WRIGHT. (A. & C. Black Ltd. 10/6)

XI.—THE COMING OF THE LIFE-BOAT

FROM the earliest times when man first left his local lakes and streams and set out to navigate the great waters, the peril of shipwreck has always been present. In days when the art of sailing was only dimly understood, and when there were no charts to guide the seaman, the proportion of ships lost must have been very large. Shipwrecks then appear to have been regarded as very unfortunate, but at the same time inevitable; and no attempt seems to have been made to introduce means of saving the lives of those concerned.

This attitude persisted indeed almost up to the 18th century, and no particular endeavours seem to have been made to rescue the crews of ships wrecked even close to land. As a matter of fact, wrecks were regarded by certain classes of coast dwellers as affording a welcome opportunity for plunder. Normal wrecks did not occur sufficiently often to satisfy the greed of these robbers, so they deliberately lured ships on to dangerous rocks by means of misleading lights on shore, and many a good ship came to her doom in this manner. Gradually the deliberate wrecking of ships was suppressed, and the coastal population made to realise that the contents of a wrecked vessel were not the property of any man who could grab them.

This state of affairs did not exist everywhere, however, for on many parts of the coast the local fishermen were always ready to do their utmost to rescue the crews of doomed ships, even at the risk of their own lives. Sometimes these gallant attempts at rescue were successful, but very frequently they were not; and from time to time various schemes were put forward with the object of reducing the terrible loss of life. It was realised that in many cases crews were lost on account of the capsizing of the boats in which they escaped from their ships. It was obvious that the trouble lay in the unsuitable nature of these boats, and various inventors sought to design boats which, by reason of increased strength and stability, would ensure greater safety to the occupants. These inventors seem to have confined their attention to ships' boats, and not to boats specially suitable for launching in a rough sea and rowing out to a vessel that was wrecked or in difficulties.



William Wouldhave, the first to build a self-righting model Life-boat

In 1765 a man named de Bernières, who was at that time Controller-General of Roads and Bridges in France, designed a boat that he claimed would remain afloat when full of water, and would not capsize even when greatly overloaded. Additional buoyancy was given to the boat by the installation of air-boxes in the bow and the stern, an example that was followed by later inventors of life-boats. De Bernières' boat was to accommodate nine persons. Further details of it are lacking, and there is no record of its adoption.

The first Englishman to devote himself to the problem of increasing the buoyancy and stability of boats was Lionel Lukin, a coachbuilder of Long Acre, London, who in 1784 designed a boat that he claimed would prove unsinkable. Encouraged in his efforts by the Prince of Wales, afterwards King George IV., Lukin converted a Norway yawl into a life-boat on the lines he had devised. This boat was tested on the Thames, and in consequence of its considerable success he took out a patent for his invention on 2nd November, 1785.

Lukin then published a pamphlet describing the principles of what he called his "*Insubmergible Boat.*" In this description he states that buoyancy was obtained by means of air chambers inside, one at the bow and another at the stern of the boat, and by a belt of cork projecting "in a faint curve, towards the water, so as not to interrupt the oars in rowing . . . ." A false keel "of cast iron, or other metal" was fitted along the centre of the true keel, to give the boat increased stability. The boat had no means of righting itself if overturned, and possessed no facilities for discharging any water that might be taken on board.

In order to have his boat tested under actual service conditions Lukin persuaded a Ramsgate pilot to take the boat out to sea and test it thoroughly during rough weather. The boat was duly shipped on a vessel that the pilot was taking out—and Lukin never saw it again! Exactly what happened to the boat does not appear to be definitely known, but it was rumoured later that it had been used for making Channel crossings.

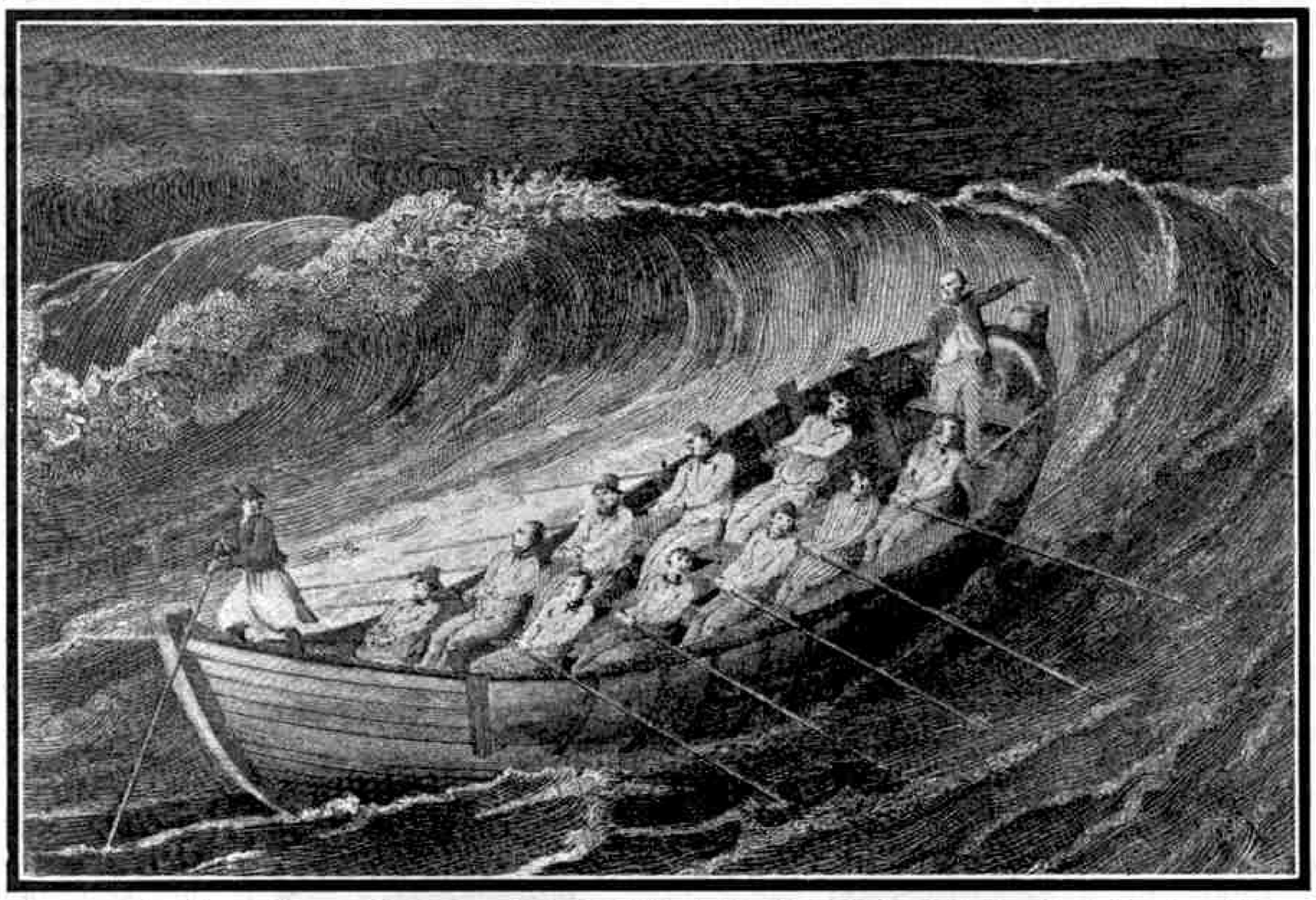
An interesting description of Lukin's invention was found in an old letter and is worth quoting:—"The boate ytself is built of wainscotte, and for shape excels all models for shippinge; twoe men will easily carrye ytt on lande between them, yet are they so secure in them at sea, that some in a storme have lyved aboarde three days. Their greateste danger is nearest home, when the waves breake dangerouslye; but they, acquainted with these seas, espyinge a broken wave reddy to overtake them, instantly oppose the prowe or sharpe ende of theyre boate into yt, and mountinge to the top, descende downe as it were into a valley, hovering untill they espye a whole wave come rowlinge, which they observe commonly to be an odde one; whereupon mountinge with their cobble as it were a great furious horse, they rowe with might and mayne, and together with that wave drive themselves on lande."

Lukin's invention came to the notice of the Archdeacon of Northumberland, who was one of the trustees of an estate that included Bamburgh Castle, on the Northumbrian coast. At this point many wrecks occurred in rough weather, and the regularity and extent of these disasters awakened in the Archdeacon a great desire to do something to reduce the terrible loss

of life. Under his instruction a portion of the castle was repaired, and from the tower a constant watch was maintained. When the watcher sighted a ship in distress he signalled the information to the fishermen at Holy Island, who often were able to row out to a ship on occasions when the weather was too rough for a boat to be sent from Bamburgh.

When the weather was too bad for observation to be maintained from the watch tower, the coast was patrolled by two men on horseback, who notified the castle of any vessel in difficulties. Immediately such information was received at the castle a gun was fired, which served the double purpose of giving the alarm to the local fishermen and of summoning the Customs Officers, whose duty it was to ensure that the vessel was not plundered.

The Archdeacon was quick to appreciate how valuable to the fishermen would be a boat that could withstand the pounding of the heavy seas without capsizing. He obtained from London a coble—a low, flat boat with a square stern, particularly well suited for launching in heavy surf—and requested Lukin to convert it into a life-boat. Lukin did so, and the boat was duly stationed at Bamburgh Castle and was the means of saving many lives. This boat has the distinction of being the first life-boat to be stationed on any coast.



A reproduction of an old engraving depicting the "*Original*," the first boat built for use specially as a Life-boat. This was constructed by Henry Greathead in 1789

The subject of rescuing shipwrecked sailors aroused little public interest until the wreck of the "*Adventure*" near Newcastle during rough weather on 15th March, 1789. The circumstances of this disaster were extremely tragic, for the ship stranded on a sandbank when only 300 yards from the shore. In spite of this short distance from safety, the sea was so rough that no one dared put off to the rescue in an ordinary boat; and the thousands of spectators who had gathered on the shore watched helplessly as the heavy seas broke over the vessel and rapidly pounded her to pieces. As the ship broke up under the repeated onslaughts of the sea, the horror-stricken crowd saw the exhausted crew drop from the rigging one by one and perish.

On a part of the coast at South Shields that is higher than the rest and is known as "The Lawe," was a building used as a club by a local association styled "*The Gentlemen of the Lawe House.*" The newsroom of the club overlooked the entrance to the Tyne, and from this elevated view the members witnessed many terrible shipwrecks. The wreck of the "*Adventure*" so distressed them that they called a meeting to discuss what action could be taken to prevent the recurrence of such heavy loss of life. It was finally decided that a life-boat offered the best solution to the problem, and a committee was formed to determine the essential characteristics of such a boat. When this had been done an advertisement embodying the conditions was inserted in the "*Newcastle Courant.*" In this advertisement the committee offered a premium of two guineas for the best plan or model of a boat capable of being launched in heavy surf, and of riding safely the stormy seas at the mouth of the Tyne.

The offer induced several inventors to submit plans and suggestions, and in two instances at least the specifications were supplemented by model boats. One of these models was submitted by William Wouldhave, a painter living at South Shields. It is not known how this man became interested in the subject of life-boats, but for some time he had been endeavouring by experiment to design a boat of the type now called for. A local firm of brewers had permitted him to test his models in their tanks, and this assistance was of great value to him.

Sir William Hillary, Bt., who founded in 1824 the great organisation now known as The Royal National Life-boat Institution

Wouldhave greatly desired to design a life-boat that would be capable of righting itself without capsizing but the principle that would make this possible continually eluded him. As has been the case with many other inventions, the vital idea so earnestly striven for was discovered accidentally. While out walking one day Wouldhave came upon a woman who had just filled her pail with water from a well. She had employed the half of a round, high-rimmed wooden dish to ladle the water into the pail, and this now floated upon the surface of the water. He stopped to chat with the woman, and while doing so he casually attempted to turn over the half-dish, but he found that it would not remain inverted and always quickly righted itself.

This incident immediately attracted Wouldhave's attention and, after repeated failures to make the dish remain upside down, he realised that its self-righting capacity was due in large measure to its shape. He hurried away to the brewery and commenced experimenting in the light of his new knowledge, and before long he had devised a self-righting boat. The model that he submitted to the "*Lawe House*" committee on 1st October, 1789, testified by its high-peaked ends to the importance of the discovery he had made at the well. The model was made of tin. It had water-tight cases containing cork in the high prow and the stern, while cork was laid also along the inside of both gunwales and above the floor amidships. The boat had a straight keel and the sides had considerable sheer.

The other model that was submitted to the committee was constructed by Henry Greathead, also of South Shields, who was a boat builder by trade. His boat was constructed of wood, and had a flat bottom and was shaped like a raft.

The committee were not wholly satisfied with any of the various boats proposed, but they considered Wouldhave's model to be most suitable and they offered him half the premium. Although only a poor man, he considered that he was entitled to the full award, and declined the committee's offer of half. He did not reclaim his model, which has been carefully preserved and is now

housed in the South Shields Public Museum.

Nicholas Fairles, the chairman of the committee, and a member named Rockwood then modelled in clay a life-boat in which they incorporated many of the features of Wouldhave's model. When the model had been approved by the committee, Greathead was commissioned to build a full-size life-boat in accordance with it. Greathead recommended that the boat should have a curved keel and his suggestion was accepted. When the boat was completed it was named appropriately *"The Original,"* and was stationed at The Lawe, thus making South Shields the first organised life-boat station in the world.

"The Original" was 30 ft. in length, 10 ft. in width and 3 ft. 4 in. in depth amidships. It was protected externally for a distance of 21 ft. 6 in. along each side by a cork "fender," or belt, that was 1 ft. 4 in. in depth and 4 in. in thickness. A similar cork covering 1 ft. in thickness was fitted on the inside of the hull and extended upward from the deck to the thwarts. Altogether nearly 7 cwt. of cork was used in equipping the boat. Twenty persons could be accommodated, and it was propelled by 10 oars.

"The Original" was in commission until 1830, when during rescue work it was dashed on to the rocks and subsequently broke up. During its 40 years of service the boat was the means of saving hundreds of lives, and it was handled so skilfully that no member of the crew was ever lost.

No other life-boat was launched until 1798, when the Duke of Northumberland commissioned Greathead to build a life-boat for North Shields, and provided an endowment for its maintenance. Two years later the Duke ordered another life-boat from Greathead and presented this to the town of Oporto. These orders marked the definite beginning of Greathead's career as a builder of life-boats. By the close of 1803 he had constructed no less than 31 boats—18 for England, five for Scotland, and eight for abroad. All these were oar-propelled boats, and were not provided with sails. Greathead's success in the building of life-boats earned him several awards, including a grant of £1,200 from Parliament and a gold medal and £60 from the Society of Arts.

Henry Greathead, the pioneer builder of Life-boats

The next important event in life-boat history was the construction at Lowestoft of the first sailing life-boat. This boat was built for the Suffolk Humane Society, which appointed Lukin to design the boat and supervise its construction. The boat was 40 ft. in length, 10 ft. in breadth and 3 ft. 6 in. in depth, and was the forerunner of what is now known as the Norfolk and Suffolk type of life-boat. It was also the first life-boat designed to empty itself automatically of water.

The establishment of life-boat stations round the coasts of the British Isles progressed steadily, and by 1824 there were 39 life-boats in use at British stations. In that year occurred a memorable event—the founding of the great organisation now known throughout the British Empire and indeed throughout the world as the Royal National Life-boat Institution.

The creation of this wonderful organisation was the inspiration of Sir William Hillary who, during his residence at Fort Anne in the Isle of Man, had been greatly distressed by the frequency with which shipwrecks occurred. Many of these disasters resulted from vessels being driven into Douglas Bay during stormy weather, and on several occasions Sir William rowed out to the wreck in an ordinary boat that was never intended by its builders to be used for rescue work, and succeeded in saving many, if not all, of the crew. A typical instance of his courage and skill occurred in 1822, when H.M. brig *"Racehorse"* and H.M. cutter *"Vigilant"* were wrecked in Douglas Bay during the same storm. Altogether 100 persons were rescued from the brig and 54 from the cutter, and of this number Sir William was responsible for the saving of 84.

In the following year, while this double shipwreck was still fresh in the public memory, Sir William issued a leaflet entitled *"An Appeal to the British Nation."* In this leaflet he appealed eloquently for the foundation of a national institution to undertake the rescue of shipwrecked crews. The appeal attracted the attention of Thomas Wilson, a London merchant and a Member of Parliament for the City, and with his co-operation Sir William succeeded in obtaining the support of many of the leading public men of the day. An enthusiastic public meeting, presided over by the Archbishop of Canterbury, was held on 4th March, 1824, and a society was founded on the lines proposed by Sir William Hillary and entitled *"The Royal National Life-boat Institution for the Preservation of Life from Shipwreck."* During the first year of its existence the Institution made good progress. A sum of nearly £9,800 was collected, and 12 life-boats were built and stationed at different points on the coast.

The establishment of the Institution did not cause Sir William to relax his active rescue work, and one of his most conspicuous acts of bravery followed upon the wreck of the Royal Mail steamer *"St. George"* in Douglas Bay on 20th November, 1830. The only life-boat available was a new one not yet completed, but with two friends and a crew of 14 Sir William put off in the boat, reached the vessel and commenced the work of rescue. The task was both difficult and dangerous, and in the course of it he received a crushed chest and six broken ribs. At another moment he and three others were washed overboard and had to be rescued. Eventually the entire ship's company of 22 persons was transferred safely to the boat. For his great gallantry on this occasion Sir William was awarded the gold medal of the Institution that he himself had founded.

It is worth noting that Sir William did not retire from rescue work until he was 64 years of age, by which time he had played a part in the saving of 305 lives, and had three times been awarded the Institution's gold medal for gallantry.

In addition to awarding gold medals for acts of great courage in connection with the rescue of shipwrecked persons the Institution also bestows silver and bronze medals for similar deeds. In turning over the records of the Institution one comes across the following entry:—"1838. William Darling, Lighthouse Keeper, Silver Medal. Grace Darling his daughter, Silver Medal." This entry is a reminder of a wonderful story of heroism.

Grace Darling was born at Bamburgh on 24th November, 1815, and at the time of this great event in her life she was living on one of the Farne Islands in the lighthouse of which her father was the keeper. On 7th September, 1838, the *"Forfarshire,"* a small passenger steamer of some 300 tons bound from Hull to Dundee with 60 persons on board, was wrecked in a terrific storm on some rocks in view of the lighthouse. There appeared little hope that any on board could be saved, but when daylight came the lighthouse keeper saw that some survivors were still clinging to the rock. He was desperately anxious to effect a rescue if possible, but it was clearly beyond his power to row his coble unaided to the rock. While he hesitated, his daughter volunteered to accompany him, and although the venture seemed utter madness the boat was duly launched, and after terrific efforts father and daughter succeeded in reaching the rock and rescuing four men and one woman. Subsequently the lighthouse keeper made a second trip with the help of two of the rescued men and succeeded in saving the remaining four survivors.

Toward the middle of last century the public began to lose interest in life-boats, and although the work of life-saving continued unrelaxed, the income of the Institution—which was, and is still, derived entirely from voluntary contributions—decreased steadily, and in 1849-50 was as low as £354. Public apathy received a rude shock in 1849, however, when the life-boat *"Providence,"* while out on rescue work at the mouth of the Tyne, capsized, with the loss of 20 of her crew of 24. This tragedy had the good effect of re-directing public attention to the needs of the life-boat service.

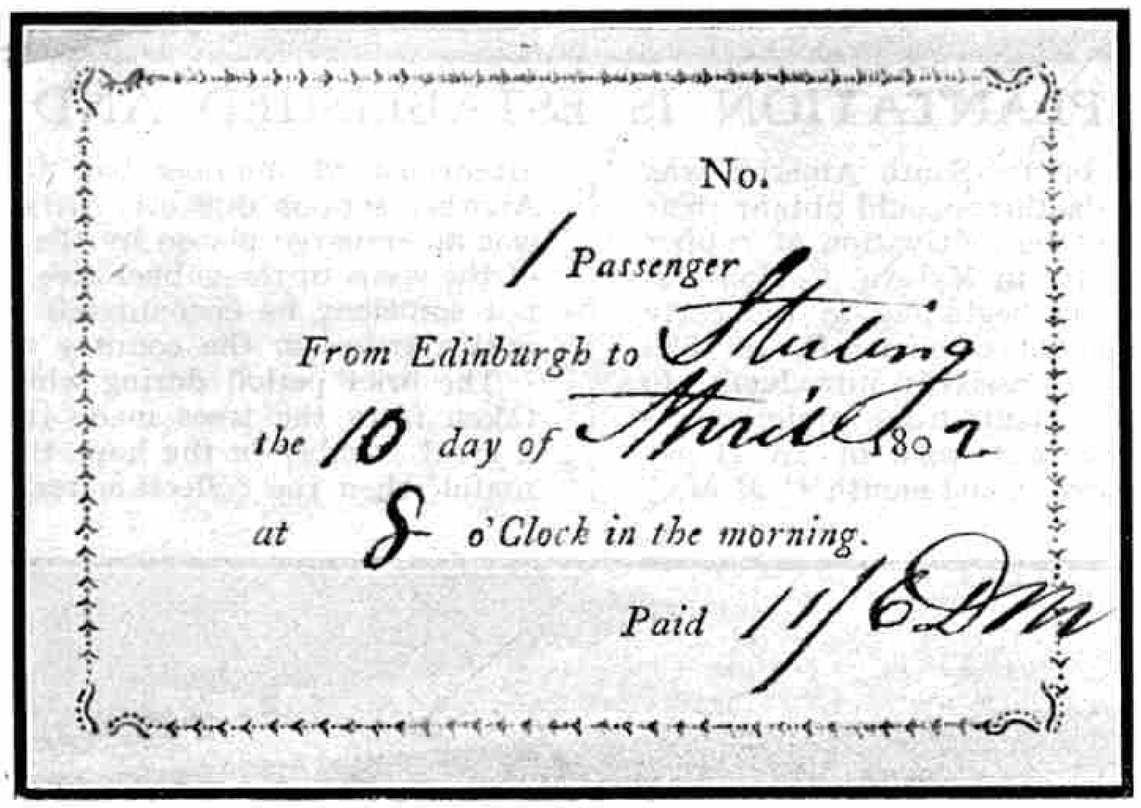
The illustrations accompanying this article are from originals in the possession of the R.N.L.I. The blocks of the portraits were kindly lent to us by the Editor of *"Mersey."*

(To be continued)

Coaching Days and Ways

An Interesting Old Coach Ticket

THE two illustrations on this page reproduce a mail coach ticket issued in Edinburgh nearly 130 years ago. On the back are details of coaches that travelled westward from Edinburgh, which may be regarded as the equivalent of a modern railway time table. As the upper illustration shows, the ticket, for the sum of 11/6, conferred upon its possessor the privilege of travelling to Stirling in what we should now regard as an extremely uncomfortable vehicle, lurching ponderously along over rough roads.



These interesting photographs remind us that the development of railways, motor cars and other means of speedy communication has been the work of little more than a century. It is, in fact, less than 300 years ago since stage coaches were first introduced. The earliest of these coaches should really be described as wagons. They travelled at less than four miles an hour, and the unfortunate passengers were jolted unceasingly throughout their journey over the appalling roads that then existed. A journey by coach in those days was indeed a real adventure, and more than one traveller has left us an eloquent account of his sufferings during a journey and his thankfulness at its conclusion!

The introduction of stage coaches aroused a considerable amount of prejudice. This is not surprising, but the reason for the prejudice is certainly very curious. The coaches were disliked, not for their clumsiness or the hardships that passengers were called upon to bear, but because they tended to make people idle and unwilling to "endure frost, snow or rain, or to lodge in the fields!" The author of one protest against coaches seems to have been quite appalled by the extent of their use. In order to demonstrate the gigantic nature of the evil against which he complained, he stated that between London and the three principal towns of York, Chester and Exeter, no less than 18 persons travelled weekly in each direction! He emphasised the seriousness of this by calculating that 1,872 persons made the journey in a year.

In spite of their discomfort, the stage coaches became popular, and as time went on conditions were greatly improved. Travelling by means of them was a very deliberate affair. The coaches usually were advertised to start "God willing," or at such an hour "as shall seem good" to the majority of the passengers. One quaint public notice exhibited in Edinburgh late in the 18th century stated that "the coach would start out from Grassmarket ilka Tuesday at twa o'clock in the day, God wullin', but whether or no on Wednesday." A day more or less was then evidently a very small matter.

It is recorded that Thoresby, a noted antiquary of 250 years ago, who often travelled from London to York, was accustomed to leave the coach, from time to time, in order to go in search of fossil shells. Evidently the current joke about getting out of the carriage to gather wild flowers on the way is considerably older than the railway of which it is usually told!

It was the use of coaches that concentrated attention upon the fearful condition of the roads, and led to the work of such famous road-building engineers as "Blind Jack" Metcalfe and Thomas Telford. So long as men travelled only on horseback or on foot, and goods were carried by packhorses, the roads remained mere narrow tracks that often became worn away until they were practically nothing but ditches. Some of the ancient tracks were actually so deep that the heads of travellers did not show above their banks!

Something more than a ditch was necessary for coaches, however, and the pioneer work of Metcalfe and Telford led to the construction of a network of splendid roads over the greater part of England and Scotland. In turn, the improved roads led to improved coaches, and journeys were considerably speeded up.

WHITE-HART INN, GRASS-MARKET, EDINBURGH.
JOHN MACKAY

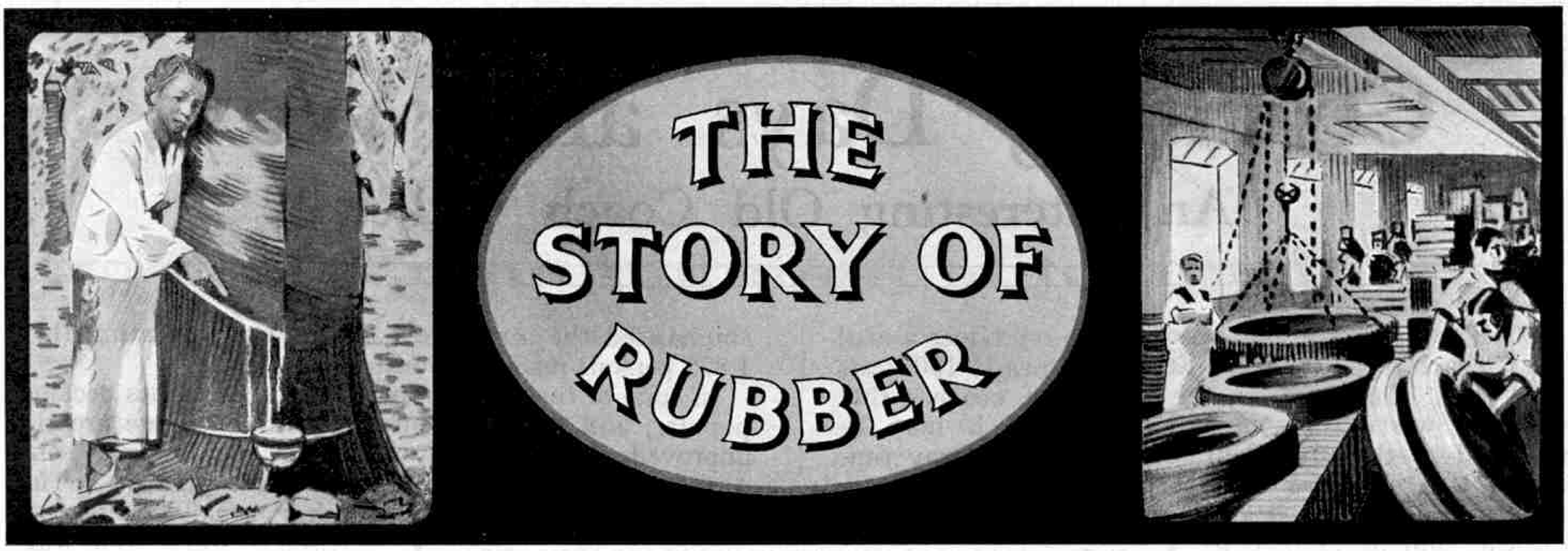
RETURNS his moſt grateful Thanks to his Friends who have ſo kindly patroniſed him at the above Inn; and reſpectfully informs them and the Public in general, that he carries on buſineſs at the WHITE-HART INN as formerly; hoping, by his attention, to merit their future favours, which he will always unremittingly endeavour to deſerve, and thankfully acknowledge.

Poſt Horſes and Neat Chaiſes, with every other article in the line.

Continue to ſet out, a Coach for GLASGOW, every day, at Nine o'clock morning. And one at Eight for STIRLING, as uſual.
Alſo a Diligence for PERTH, every Monday, Thurſday, and Saturday, at Twelve o'clock noon

☞ The Proprietors of the above Carriages will not be accountable for any Box, Parcel, &c. if above the value of Five Pounds Sterling, unleſs ſpecified on delivery, and a premium paid; and they will not take charge of money, bank-notes, plate, jewels, or valuable papers, upon any conſideration whatever.

Through the courtesy of Mr. J. A. Forbes of Bankfoot, we are able to reproduce the photograph above of the front and back of a mail-coach ticket from Edinburgh to Stirling



II.—HOW A PLANTATION IS ESTABLISHED AND WORKED

IN the early days of the rubber industry South America was the only country from which manufacturers could obtain their supplies of raw rubber, but to-day the cultivation of rubber trees is carried out on a large scale also in Malaya, Ceylon and India. This great development had its beginning in the early seventies of last century, when the India Office enlisted the services of the Royal Botanical Gardens, Kew, to assist in introducing to India rubber and other useful economic plants from foreign countries. It was due to the splendid pioneer work of Sir Henry Wickham, a photograph of whom appeared in last month's *"M.M.,"* that the rubber industry became established in India and elsewhere in the East.

The Director of the Kew Gardens obtained from Brazil several hundred seeds of the wild Para rubber plant, but of these he succeeded in growing only about one dozen plants. These plants were taken out to India in 1873 and reference to them was made in the Kew report for that year. The report stated that "Dr. King, the Superintendent of the Calcutta Botanic Gardens, has returned to his duties, taking with him living plants of the true India-rubber plant of Para, *Hevea elastica* (*brasiliensis*), the seeds of which were procured from the Amazon and sent to Kew by Mr. Markham of the India Office." At Calcutta the Superintendent took cuttings from the plants and safely planted them, but they all died after a short struggle for existence.

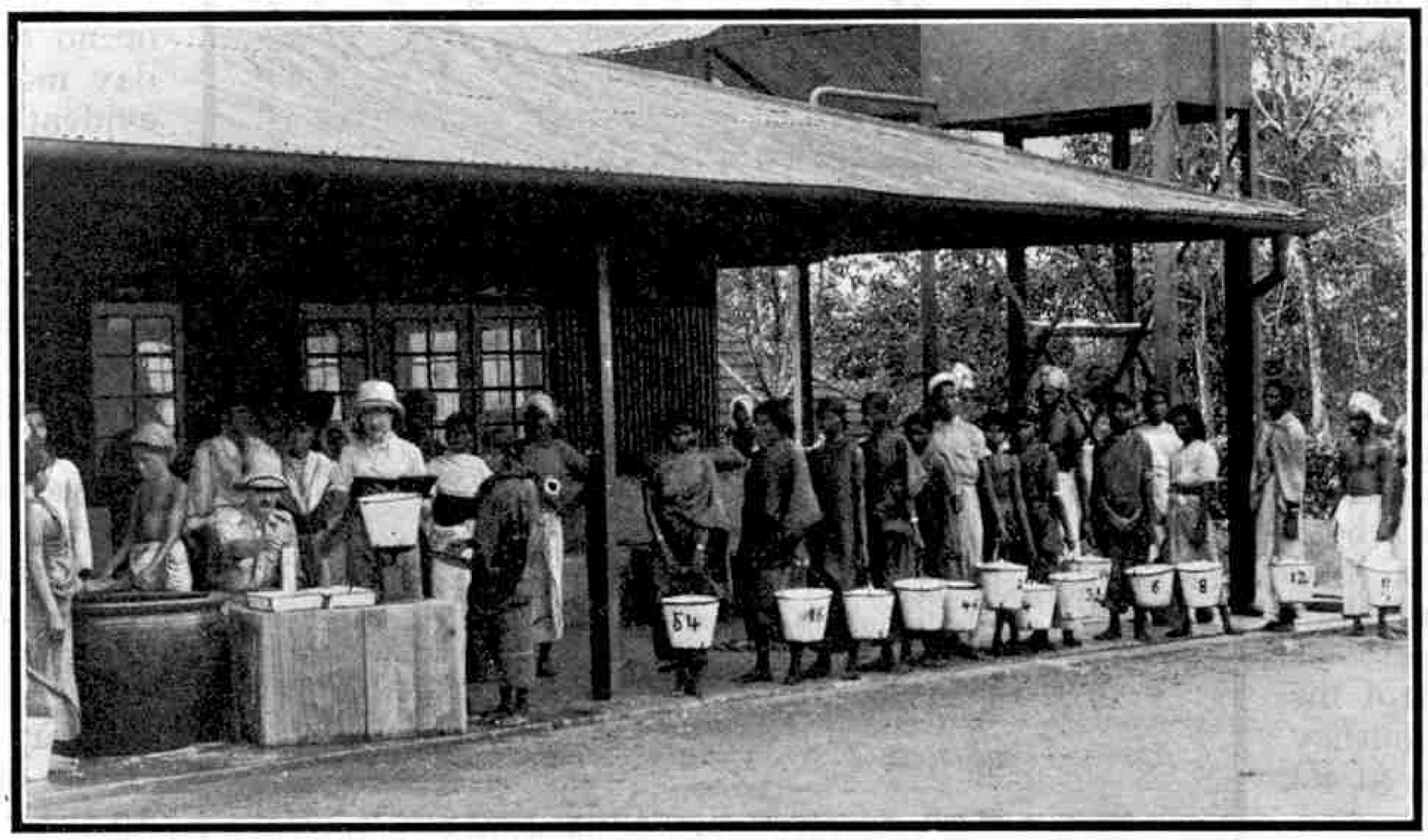
It was at this stage that the India Office commissioned Wickham to collect the same class of seeds. Wickham had been in South America for some time studying means by which large quantities of the seeds of the *Hevea-Brasiliensis* could be successfully collected and conveyed to England. The seeds are very oily, and in less than two months from the day on which they fall, or are taken from the parent tree, they become sterile. It was of the utmost importance, therefore, that any seeds collected should reach Kew Gardens with a minimum of delay. As a result of his survey of the extensive forests on the Tapajos River, Brazil, Wickham knew exactly where he could find the right kind of trees, and when he received the official order to collect the seeds he immediately went ahead with the work.

The wild rubber trees were scattered over a wide area. Food, collecting boxes and stores of all kinds had to be carried long distances through dense tropical jungle, while the unwelcome attentions of innumerable flies made life almost unbearable. Another serious difficulty with which Wickham had to contend was an embargo placed by the Brazilian Government upon export of the seeds of the rubber tree, and as though these troubles were not sufficient, he encountered considerable hostility from various native tribes in the country through which he had to pass.

The brief period during which the seeds are of use after being taken from the trees made it essential for Wickham to collect a great number in the hope that a fair proportion would still be useful when the collection reached this country. In spite of all obstacles he succeeded in collecting 70,000 seeds in a district far up the Tapajos River and hundreds of miles from the Brazilian coast. Then began a desperate race against time. Day after day Wickham pressed on through the jungle, halting only for short periods for food and sleep. With almost superhuman effort he got his precious consignment to the coast and in record time arrived at the mouth of the river.

There difficulties arose over shipment, but eventually Wickham succeeded in chartering a British tramp steamer that was awaiting a homeward freight. Apparently the captain was under the impression that he had been commissioned to ship a large and valuable cargo, the freight charges of which would yield him a handsome sum; for when he discovered that he was expected to sail to England with a cargo that consisted only of three cases his consternation was great! After interminable argument and discussion Wickham succeeded in convincing the captain that the British Government was at the back of the transaction and would amply repay him for the use of his ship. The captain then agreed to take the three cases of seeds and to run the ship home in ballast.

When the Customs officers boarded the ship to inspect the cargo before they issued the necessary clearance papers to permit the ship to leave port, Wickham realised that his troubles were not yet at an end. For a moment the fate of the precious seeds hung in the balance, but a timely inspiration led Wickham to describe the contents of the cases as "botanical specimens." Fortunately he was not called upon to open any of the cases, and without the faintest suspicion that the contents were contraband the Customs officers certified the cargo as being satisfactory! With her clearance papers safely locked up in the skipper's cabin, the ship was soon steaming homeward at full speed.

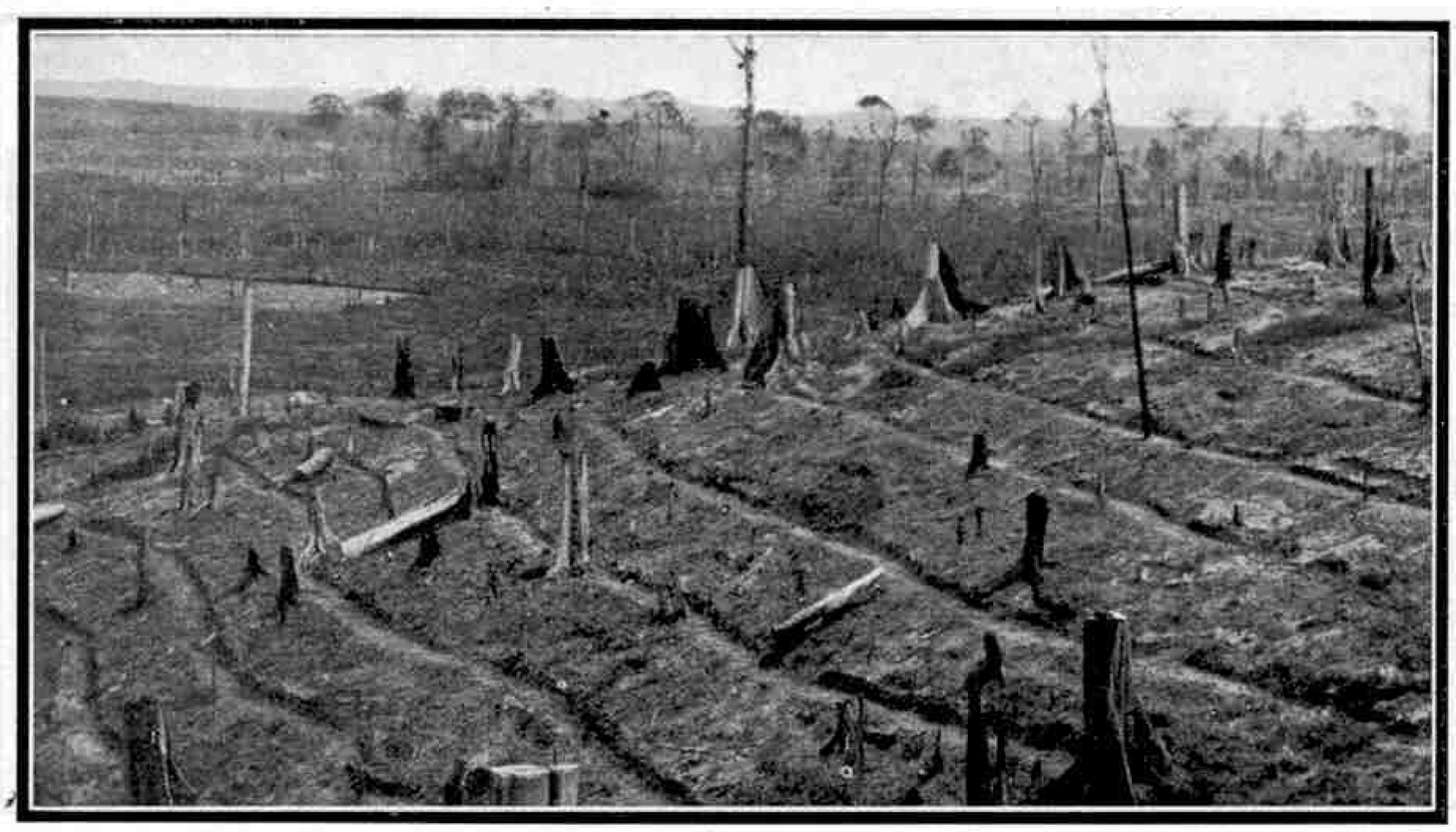


Courtesy [*Rubber Growers' Assoc.*

Coolies arriving at a rubber plantation factory with buckets of latex collected from the trees

Wickham arrived in London with his consignment of seeds on the evening of the 14th June, 1875, and immediately drove out to the Botanical Gardens at Kew, where the seeds were handed over to the Superintendent and placed in safety for the night.

Referring to the proceedings on the following day, the well-known magazine "*India*" says: "At daylight next morning there was a great commotion in the gardens; suitable plant houses were emptied, and in a very short time the whole of the seeds were planted. They were sown close together, and covered 3,000 square feet of space. About 3¾ per cent. germinated, some as early as the fourth day after sowing, and many in a few days reached a height of 18 inches. Although the intention was to make plantations of the trees in India, it was thought desirable that their establishment should first be attempted in Ceylon; therefore, on August 12 upwards of 1,900 plants were despatched in 38 Wardian cases (actually miniature greenhouses), and a young gardener from Kew was sent with them to give necessary attention during the voyage."



A section of a plantation cleared in readiness for the planting of young rubber plants. The photographs on this and the following page are reproduced by courtesy of the Dunlop Rubber Company Ltd.

In spite of the unceasing care bestowed upon the plants both during the voyage and after their arrival, a large number perished, and it is from the comparatively few survivors that the immense rubber plantations of the East have been developed. The cost of this introduction was borne by the Indian Government and is said to have totalled £1,500. On arrival at Ceylon the plants were conveyed inland to the moist and tropical region, where the majority were planted carefully in a special garden at Heneratgodde. The progress of the young trees was watched with an interest that at first was not entirely free from anxiety, but everything proceeded satisfactorily.

In the Kew report for 1878 the following interesting reference to them occurs: "Mr. Morris, the Assistant Director of the Royal Botanic Garden, Ceylon, writes (18th May, 1878): 'The rubbers are doing remarkably well, both here (Peradeniya) and at Heneratgodde. The Heveas are nearly 12 feet high and look quite handsome trees.'"

Two-year old rubber trees. The stumps of older plantings have not yet been removed

As soon as the young trees had become well rooted in their new home, cuttings were taken from them and many additional plants were reared. These were distributed to Madras, British Burma, and also to Singapore. The young trees planted at Singapore flowered for the first time in 1881, and from the subsequent fruitage seedlings were obtained and sent far afield. Among the places that received the seeds of the plantation rubber trees were the West Indies, the West Coast of Africa, the Fiji and the Seychelle Islands, and Australia.

It must not be thought that the rubber industry was of rapid growth, for it was not until the twentieth century was well established that plantation rubber, as distinct from the product of the wild rubber trees, became of commercial importance. The development of rubber plantations on a large scale began in Malaya, Ceylon and the Dutch East Indies, and to a less extent in British North Borneo, India, French Indo-China, and Burma.

In 1909 the rubber plantations produced only four tons out of a total world production of almost 54,000 tons, and seven years later the product of the plantations had risen only to 1,000 tons. From that time development went forward with increasing rapidity, and in 1914 the production of plantation rubber exceeded 71,000 tons, while rubber obtained directly from the wild rubber trees had decreased to 49,000 tons. Recent figures are even more impressive, and during 1926 no less than 600,000 tons of plantation rubber was obtained, while wild rubber amounted only to 38,000 tons.

Many of the largest trees in the tropical jungles of the countries already mentioned yield a milky juice or latex when their bark is cut, but in many instances the latex obtained yields only resin or resin-like substances when treated. Such latex is useless as rubber.

The *Castilloa Elastica*, or "Ule" tree of Brazil and Mexico, is said to have been the first tree to become known to science as a producer of rubber. At any rate, it was described as long ago as 1615 by a Spanish traveller named Juan de Torquemada, as mentioned in last month's "*M.M.*" There are several varieties of the tree and the quality of the latex yielded by them varies considerably, but by reason of the high resin content they are all inferior to the rubber of the *Hevea-Braziliensis*.

Other rubber-producing trees are *Ficus Elasticus*, a tree that grows to a tremendous size in various parts of Malay and Assam. It is this indiarubber plant that is to be seen in conservatories and houses in this country. A Central American shrub named *Guayule* produces a rubber-like substance, while from the East comes *Gutta Jelutong* rubber, a gum-like substance that forms the basis of chewing gum. Mention must also be made of *Gutta Percha*, which is mainly used for the insulation of submarine cables; and *Balata*, a similar type that is the product of a Central American tree and is used in the manufacture of golf balls. These various kinds are of only minor importance, however, and more than ninety per cent. of the whole of the world's rubber comes from the *Hevea-Braziliensis*.

This rubber-producing tree, whether wild or cultivated on a plantation, is of hardy growth. The condition of the climate is more important to it than the quality of the soil, and it will flourish on land where little other vegetation will survive. As the climate that is most favourable to the *Hevea-Braziliensis* is one that is hot and moist, the chief rubber-producing countries of the world are to be found in the tropical zone. Reference to the map that accompanied last month's article will confirm this statement.

Extreme conditions are fatal to the rubber tree, and during a drought the tree refuses to yield its valuable crop and falls an easy victim to disease. Excessive moisture is equally detrimental to it, for when the bark of the tree is damp it is impossible to collect the latex. On this account rubber trees are planted only in

soil that is provided with an adequate drainage system.

The trees attain a height of over 60 ft. and a girth of approximately 10 ft. The leaves are of a three-lobed type, while the small flowers that bloom appear in sprays. Each flower later gives place to a dry fruit that contains three large and very oily seeds. As soon as the fruit becomes sufficiently ripe it bursts with a sudden report and scatters the seed.

Seeds intended for development into trees are collected and sown in a nursery, that is a reserved plot of land the soil of which has been prepared to receive its valuable charges. The young plants develop very rapidly, and when about two years old they are "beheaded," the body and roots being pulled up and the latter trimmed carefully. The "stumps," as the plants are now called, are taken to the plantation and planted out.

General view of the central building site at a plantation. Note the coolies delivering latex at the factory on the left

Establishing a rubber plantation in virgin tropical country is an adventurous business. When the locality has been chosen, the first task is to clear it of jungle. In Malay this consists of mighty forest trees, both hard and soft wood, interspersed with smaller timber and dense undergrowth that is almost impenetrable. The valuable hard wood timber is felled and removed first, and gangs of Chinese or native labourers then cut down the remaining timber and brushwood. There is an element of danger in the work, for the forest areas are the haunt of elephants, tigers, monkeys, deers and sladang, a species of bison. When the timber and brushwood have been cut down they are left to dry, and when sufficiently dry they are ignited. When the fire has subsided the charred undergrowth and the stumps of the burnt trees are cleared away and the plantation is then laid out methodically.

Suitable sites are chosen for the necessary buildings, which include bungalows for the staff, accommodation for the natives who will be employed regularly on the plantation, factory buildings and a hospital. Roads are laid down throughout the clearing and are arranged so that they will facilitate inspection tours of the trees and render as easy as possible the transporting of the crops to the plantation factory. A comprehensive drainage and irrigation scheme is so planned that swampy areas are relieved of their excess of moisture, which is fed to the level areas.

Natives, supervised by an European, breaking up burning logs during the clearing of part of a plantation

When these important preliminaries have been attended to, the plantation is ready to receive the trees. If it is situated on level country the trees are planted in straight parallel rows, each tree equidistant from its neighbour. The number of trees planted under this arrangement averages 200 to the acre.

On plantations situated on undulating or hilly country the trees are planted in parallel rows that curve according to the contour of the land. In these instances the number of trees per acre varies from 200 to 250, and at each row a terrace is constructed about 6 ft. in width, and sloping slightly backward toward the hillside, in order to prevent loss of topsoil owing to wash caused by the tropical rains. A similar purpose is served by the low-growing plants that are installed between the young rubber plants and are known as "cover crops." These crops form a valuable manure for the soil, and this is an important function, for it is in the topsoil that the rubber tree feeds. At the rear of each row a trench or silt pit is excavated to catch the silt and to retain rain water that otherwise would drain away too rapidly down the hillside and carry with it the surface soil.

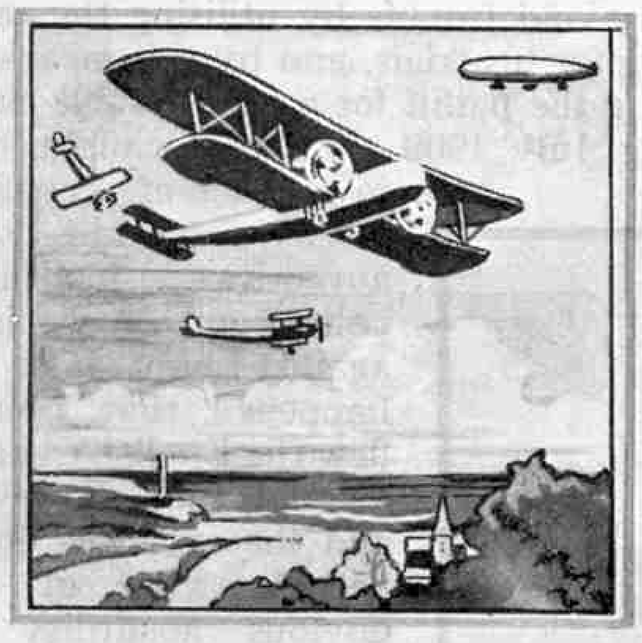
The new plantation is now complete, but five years must elapse before systematic tapping of the trees is permitted. About the third or fourth year the trees are tested for their yield of latex, and from the results obtained the planter learns which are the least fruitful trees. These are marked down for removal in order that the best yielding trees may have ample light and air for their development. This thinning out process often is spread over a period of eight or nine years, and when the work is completed the number of trees remaining on each acre probably does not exceed 80.

In Malay the tapping of rubber trees is carried out either by Tamil, Javanese or Chinese labourers. The method employed is to make in the bark of the tree an incision from which exudes the milk-white latex. Numerous arrangements of cuts have been devised for extracting the liquid, but practice is now more or less settled. A spiral cut is made in the bark of the tree round half, one third or a quarter of the circumference of the trunk, at an angle of about 35 degrees. On very large trees the cut is V-shaped on half of the circumference. A thin shaving of bark is pared off the cut, and the latex exudes and runs down the cut into a cup made of porcelain, aluminium or other suitable substance. This cup is attached to the trunk at the base of the cut and the latex is guided into it by means of a small tin spout. One gallon of latex yields an average of $3\frac{1}{2}$ lb. of dry rubber, and the average amount of dry rubber obtained from each tree on a half cut is approximately $\frac{1}{3}$ oz. per day.

At some plantations it is the practice to tap the trees daily and then rest them for a period of weeks, but usually the paring of the bark is done on alternate days. On this system the tapper absorbs a minimum of 1/20th in. of bark per day, working on half the circumference of the tree. He thus uses 9 in. of bark each year, and in 10 years has absorbed all the virgin bark. By that time, however, new bark has formed on the lower part of the tree, and the process can be recommenced.

Tapping rubber trees is a skilled process, and it is only the most expert tappers who can work to the minimum just stated. If tapping is carelessly done and the inner surface of the tree is injured, the bark renews more slowly and so unevenly as to make further tapping difficult, if not impossible.

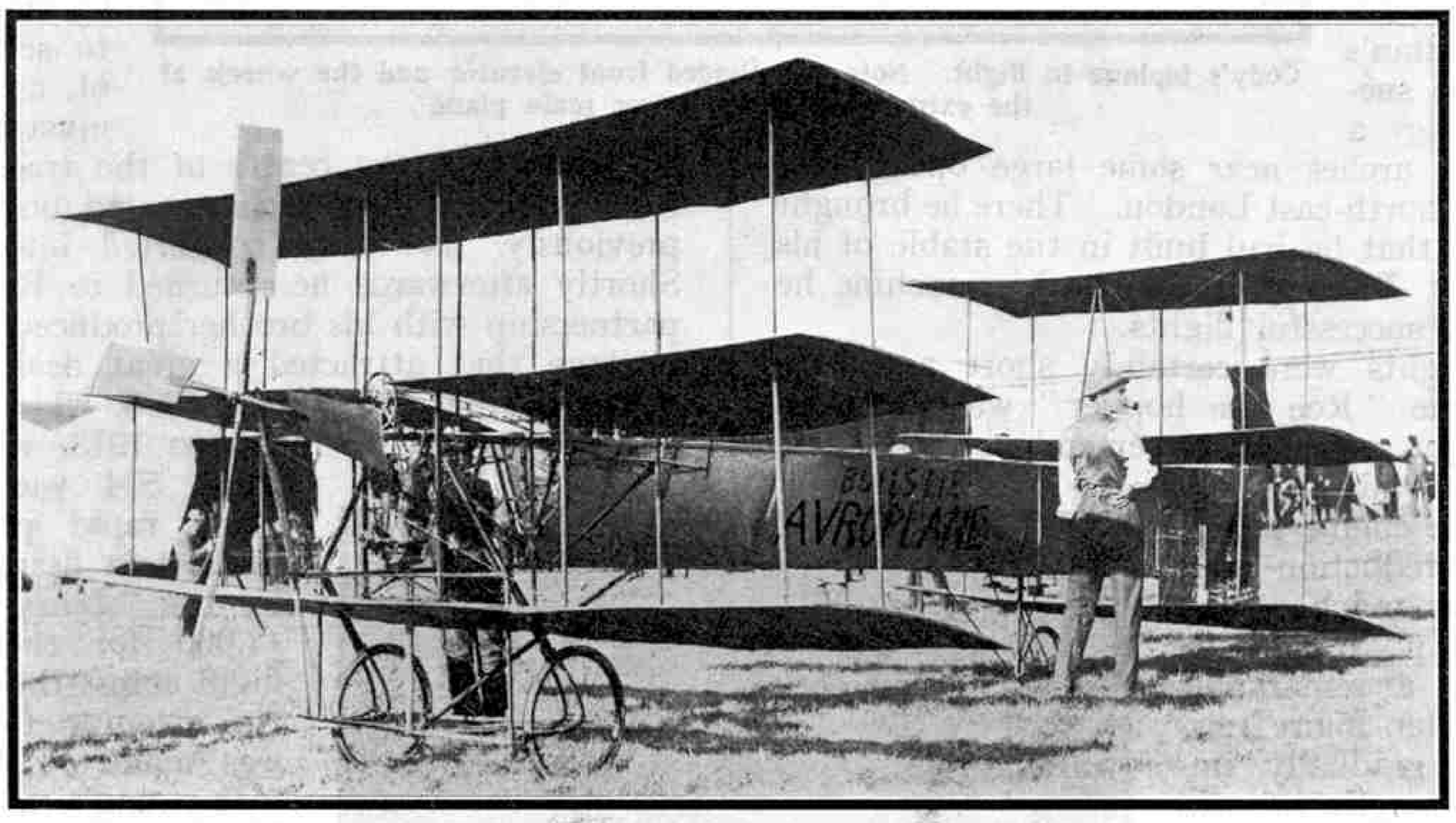
The plantation is marked off into divisions, a few natives being appointed to each section to tap the trees (*Continued on page 425*)



The Conquest of the Air

DEVELOPMENT OF THE AEROPLANE

NO account of the development of the aeroplane would be complete without reference to Samuel Franklin Cody who, according to a recent decision of the Royal Aero Club Committee, was the first man to make a free flight in this country. Cody commenced his aeronautic investigations about 1902, and during the following six years he carried out some 200 experimental flights with man-lifting kites. These kites were huge, unwieldy structures, built to his own design. Their size rendered them the subject of much ridicule in the press, while the public developed the habit of referring to them as "Cody's Cathedrals."



The "Bull's Eye" triplane in which Sir A. V. Roe competed at the first official aviation meeting in this country, held at Blackpool during October, 1909. The great height of the machine can be gauged by comparison with the man on the right of the photograph

In 1908 Cody turned his attention to constructing a power-driven aeroplane, and it was in this machine that he made the pioneer flight just mentioned. Subsequently Cody built other machines, all to the same general design, but each including certain improvements. In 1911 the War Office offered prizes for efficient flying machines suitable for military use, and they were so impressed with the possibilities of Cody's machine as a scouting unit that they awarded him £5,000 for his invention.

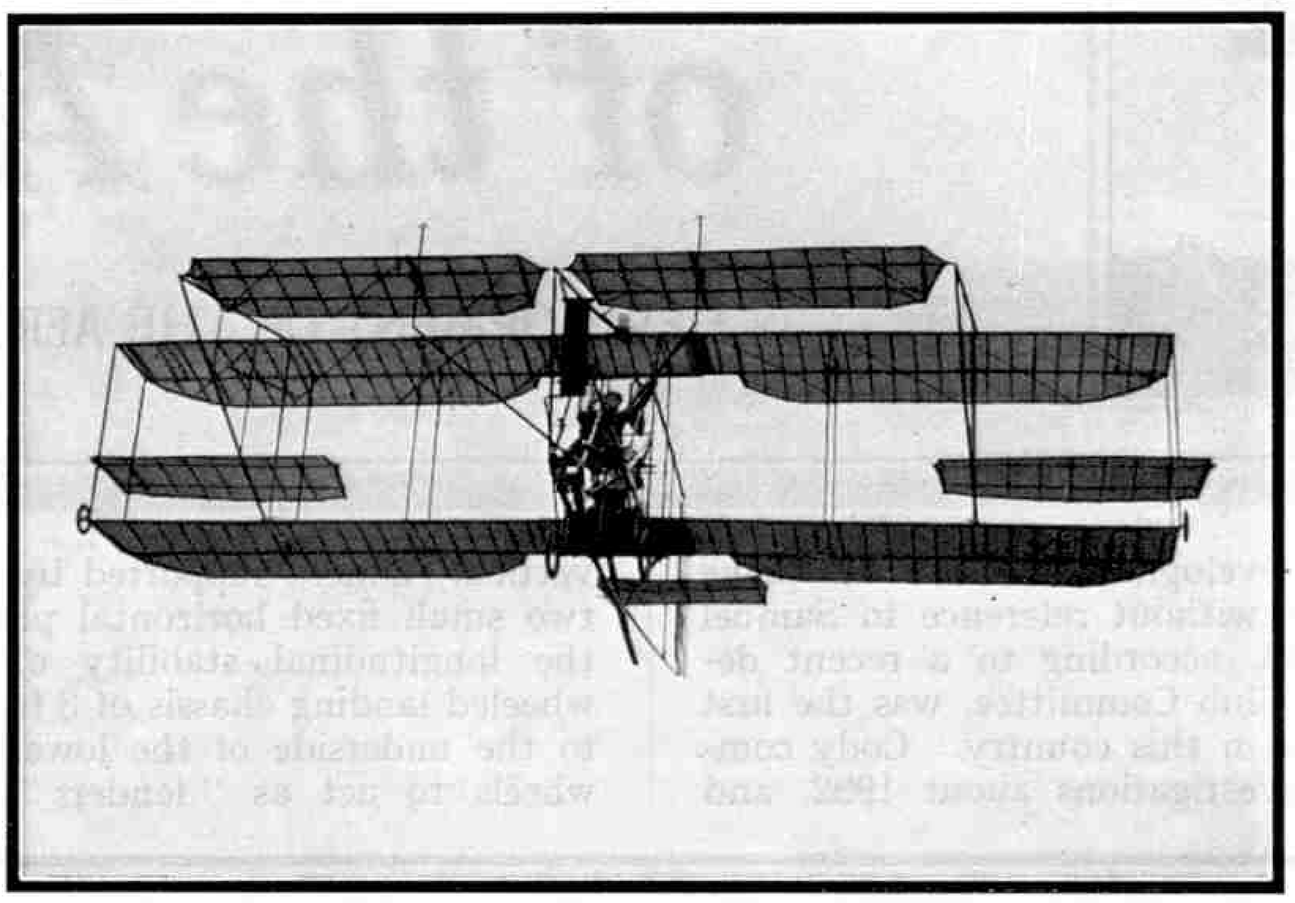
Cody's aeroplane had a wing span of 43 ft. and a total wing surface of 500 sq. ft., of which 430 sq. ft. were accounted for by the main planes. The machine was of the biplane type and had an extensive front elevator divided into two portions carried in front of the main planes. The elevator was supported at its extremities by long bamboo poles called "outriggers," that projected from the struts between the main planes; and at the centre by similar outriggers attached to the centre of the upper main plane. In place of a rear elevator the machine had a tail consisting of twin vertical rudders supported by outriggers, together with two small fixed horizontal planes intended to preserve the longitudinal stability of the machine. A four-wheeled landing chassis of 3 ft. 6 in. gauge was attached to the underside of the lower main plane, while small wheels to act as "fenders" were fitted to the tips of this plane.

The machine had a 120 h.p. motor carried on bearers mounted on a platform supported from the chassis by diagonal struts. The propeller was of Cody's own design and was 10 ft. 6 in. in diameter. It was driven from the motor at a low speed by means of twin roller chain reduction gear. Steering control was by means of a universally-pivoted rod surmounted by a handwheel. This rod could rotate freely on its axis or could be moved freely in either a lateral or fore-and-aft direction.

The successful flights achieved by the Wright brothers did not arouse much interest in this country. Among the few individuals who saw in the American airmen's accomplishments the dawn of a new era in travel was Mr., now Sir A. V. Roe, and he wrote to "*The Times*" in support of his views. It is amusing now to recall that the engineering editor of "*The Times*" added a footnote to this letter in which he said that all attempts at artificial flight in the manner suggested by Mr. Roe were not only dangerous to human life but were foredoomed to failure from an engineering standpoint! Roe was convinced that artificial flight could be made a practical success, however, and from 1906 onward he devoted his time and savings to this end.

His first step was to design and build a full-size flying machine, for which he ordered a 24 h.p. 8-cylinder Antoinette engine. The aeroplane was housed at

Brooklands, and while awaiting the engine he made several flights, in which he started off with the aid of tows from motor cars. These flights almost invariably ended in crashes, as the towers would hang on too long in their excitement! The engine finally reached him in the spring of 1908, and on 8th June of that eventful year he accomplished a flight of 60 yds. at a height of about two feet from the ground.



Cody's biplane in flight. Note the divided front elevator and the wheels at the extremities of the lower main plane

At this point Roe's troubles began. First of all he received notice to quit Brooklands, where he had never been popular with the management, who seemed to have forebodings of the track being covered with the wreckage of aeroplanes! Then the War Office refused him leave to erect his shed alongside that of Cody at Laffan's Plain. Finally he succeeded in renting a couple of railway arches near some large open fields at Lea Marshes in north-east London. There he brought a tractor triplane that he had built in the stable of his brother's house at Putney, and with this machine he carried out many successful flights.

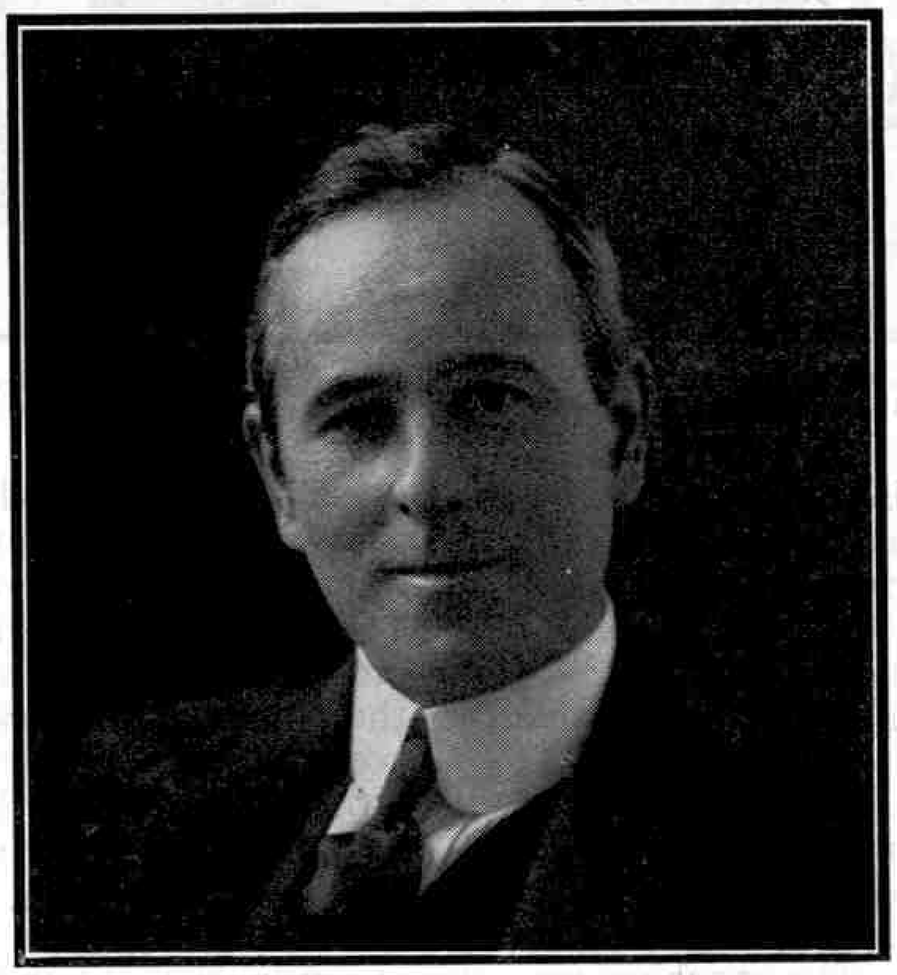
These early flights were certainly short and low, and the nick-name "Roe the hopper" was probably well-deserved. But when it is remembered that his motive power was only a 9 h.p. J.A.P. motor cycle engine which, together with its reduction gear, weighed nearly as much as the subsequent 50 h.p. Gnome, it was undoubtedly a remarkable achievement. After many mishaps his flights gradually improved until at length he was able to cover a distance of 300 yds. at a height varying from 6 ft. to 10 ft. above ground.

An amusing story is told of a young woman who went down to commit suicide in the river Lea, but went home again when she saw the aeroplane. She had only changed her mind with regard to the manner of her suicide, however, for she wrote to Roe urging him to let her take his place in the machine so that his life would be saved at the expense of hers. Roe very tactfully promised that he would allow her to fly the machine when he had perfected it, thus leaving her something to which she could look forward and so postponing the suicide.

There was some doubt at this time as to whether flying in public places was legal, and Roe was not allowed to continue his experiments in peace, the local authorities employing a bailiff to prevent him from flying. He tried to avoid trouble by utilising the early hours of the morning for his trials, and by this means he succeeded in avoiding the bailiff for a considerable time. But one day during July 1909 the bailiff caught him in the act of preparing to fly, and the local authorities instituted police court proceedings against him. It so happened that Blériot flew the English Channel at that time, however, and the case was dropped in view of the obvious absurdity of placing obstacles in the way of progress.

Roe then moved to Wembley Park, where the great Empire Exhibition was held, and there he made constant flights with increasing success. Other people by this time had begun to see the possibilities of aviation, and Roe must have smiled when he heard that the centre of the track at Brooklands, from which he had been evicted only a year or two previously, had been converted into an aerodrome! Shortly afterwards he returned to Brooklands, and in partnership with his brother produced a 35 h.p. tractor triplane that attracted a great deal of attention.

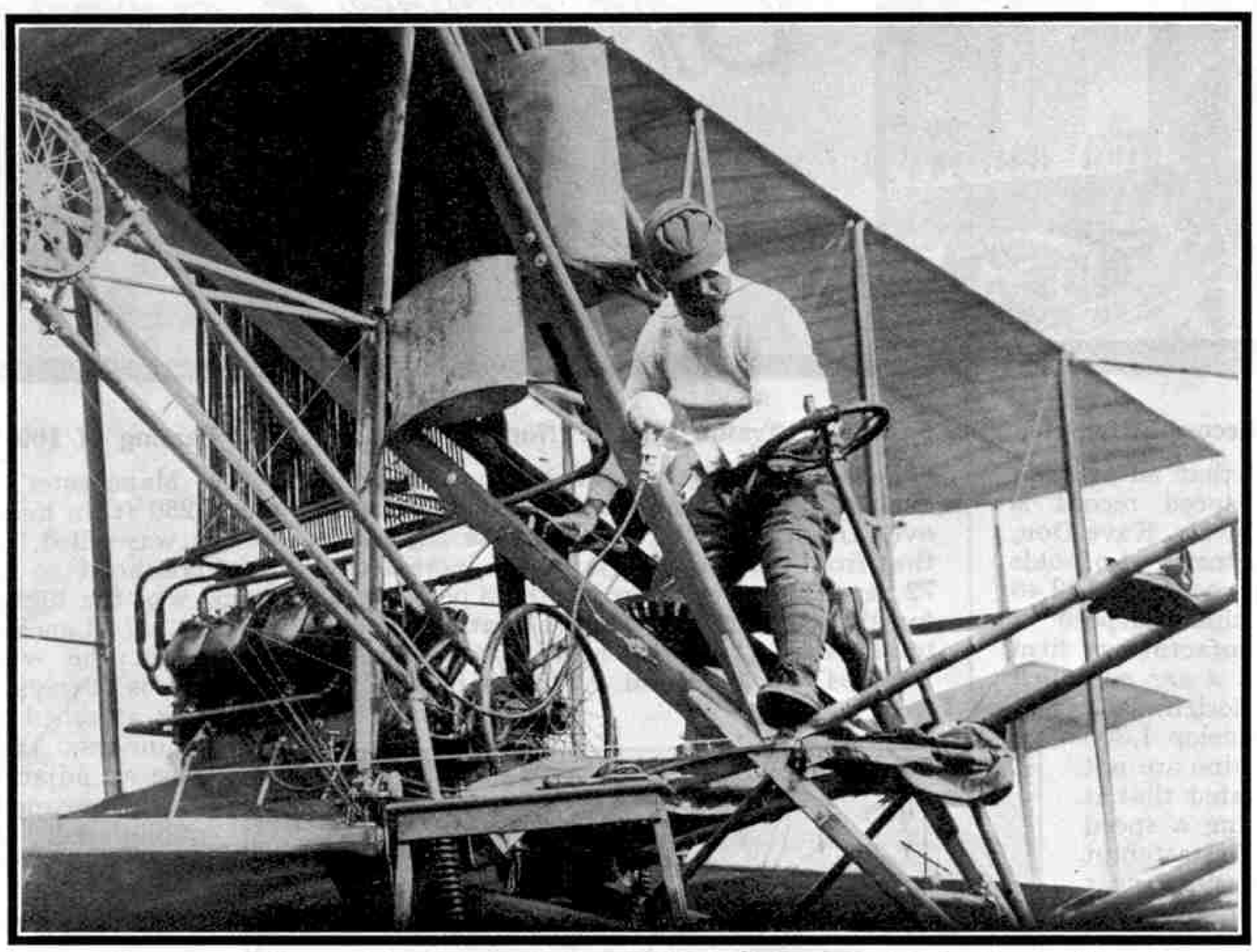
During the period from 1908, when Roe carried out his first aeroplane flight, to 1913, when the earliest Avro 504 was built, aviation made rapid progress. Public interest in flying was stimulated by the "*Daily Mail's*" offer of £1,000 for the first aeroplane flight across the English Channel. An attempt to win this prize was made on 19th July, 1909, by a young airman named Hubert Latham. He took off from Sangatte, near Calais, on an Antoinette monoplane, and as the machine sped away from the French coast the news of the start of the flight was conveyed by wireless to Dover, where a crowd of several thousands awaited news of the airman and a sight of his machine. As time passed and the airman did not appear, the crowd began to fear that a disaster had occurred, but their anxiety was relieved when a French torpedo boat, which had been detailed to follow Latham, arrived at Dover with him on board. When about seven miles out from the French coast Latham had been forced to descend into the sea owing to engine trouble. The aeroplane was kept afloat by the buoyancy of its hollow wings until the torpedo boat came up, took Latham on board, and towed the machine to Dover. Latham returned



Sir Alliot V. Roe, pioneer British aviator

hurriedly to France, obtained a new machine and commenced preparations for another attempt.

In the meantime Louis Blériot entered the contest. His experiments in aeronautics dated back to 1901, when he built a glider with flapping wings like those of a bird. This machine proved to be of no practical value, however, and in 1906, in conjunction with Charles Voisin, he built his first biplane. This was followed by the construction of a monoplane that resembled a duck flying with outstretched neck, but when tried out this machine accomplished one short hop and then crumpled up. In the following year another monoplane was built in which Blériot succeeded in flying a distance of about 120 yds., but he made a bad landing and the machine shared the fate of its predecessors.



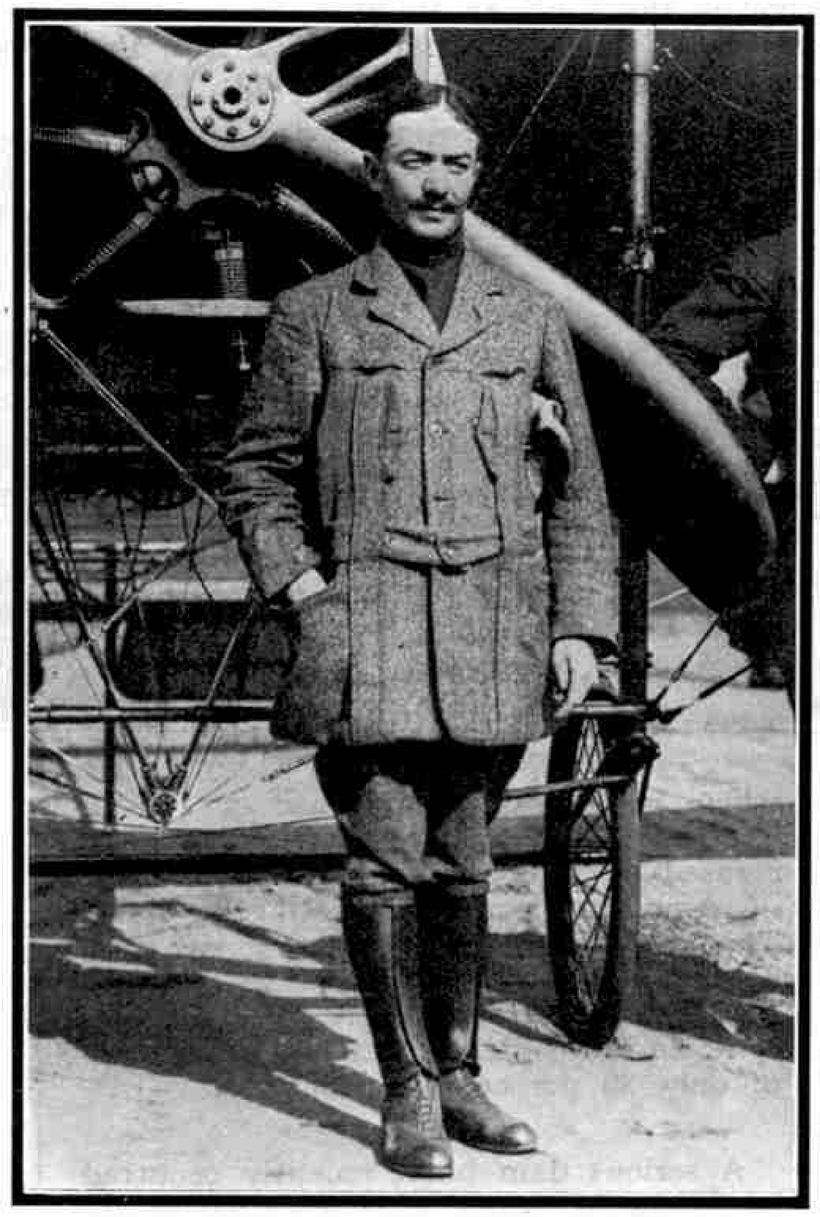
Samuel Franklin Cody manipulating his power-driven aeroplane. The illustration gives a good idea of the equipment and the crudeness of the machine's construction

Undeterred by this extraordinary sequence of failures, Blériot designed and constructed another monoplane, and in this machine he achieved distinction by accomplishing a cross-country flight of 25 miles. The monoplane is said to have been one of the smallest machines constructed up to that time. It was only 484 lb. in weight, and was equipped with a three-cylinder engine of 25 h.p. The success of the 25-mile flight encouraged Blériot to attempt the Channel crossing with the same machine, and in preparing it for this task he provided a large air bag inside the frame to ensure the machine remaining afloat in the event of a forced descent having to be made into the sea.

Rough weather delayed the start for several days. The wind abated during the night of the 24th July, 1909, and an hour or so after midnight Blériot motored from his hotel to the big marquee near the shore in which his machine was accommodated. The monoplane was wheeled out and Blériot made a brief trial trip to satisfy himself that everything was in perfect order. All was well, and he then took off on his great flight and soon was out of sight.

"I could see the destroyer "*Escopette*" a few miles out to sea," Blériot related afterward, "and as she was to steam toward Dover I took my bearings from her. The destroyer was steaming at full speed, but I very quickly passed her. My machine was then travelling at about 45 miles an hour, the revolutions of the propeller being about 1,200 to 1,400 a minute. While travelling over the Channel my monoplane was at a height of about 250 ft. At times she dipped a little but I always got her to rise again . . ."

Only a few people were about when Blériot flew over the English coast near Dover, and a policeman on night duty was the only person who actually witnessed the airman's descent. A stone monument on which is engraved a representation of his machine has since been erected on the spot where he landed.



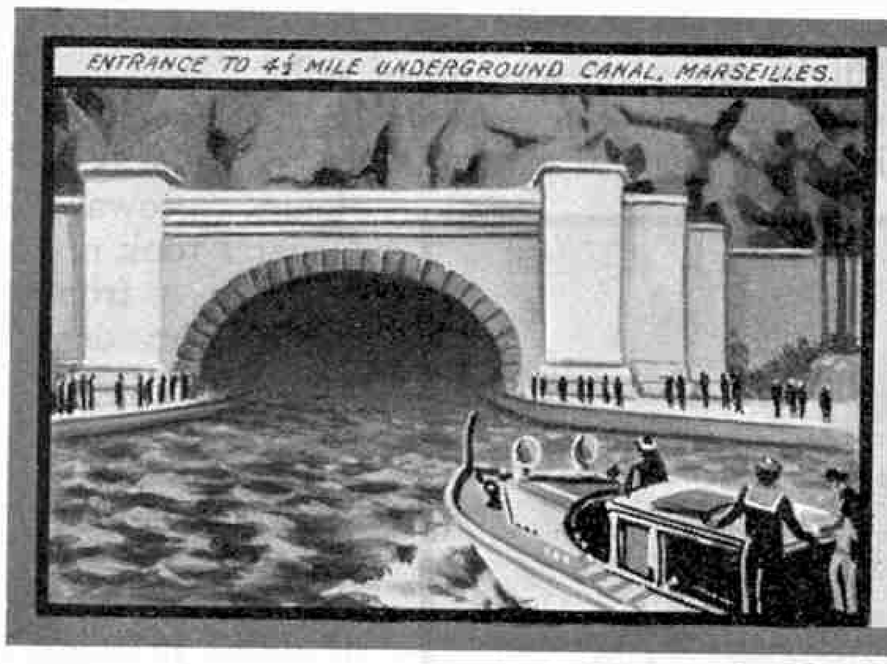
Louis Blériot, the first airman to cross from France to England by air

Blériot journeyed from Dover to London by train and was greeted at Victoria Station by a large crowd of enthusiastic admirers. His machine was exhibited for four days in Oxford Street, and during that brief period it was inspected with keen interest by about 120,000 people.

The first Channel flight in the reverse direction, from England to France, was achieved on 2nd July of the following year by the Hon. C. S. Rolls, who covered the distance in 48 minutes. As it was his intention to carry out a non-stop flight from England to France and back, he did not land on French territory but, after circling over Sangatte and dropping three envelopes containing messages addressed to the Aero Club of France, he turned his machine toward the Channel again. A vast crowd of spectators awaited him at Dover, where he made a safe landing. Rolls accomplished the total journey of more than 50 miles in less than one-and-a-half hours.

The first official aviation meeting in this country opened at Blackpool on 18th October, 1909, and it is significant of the small progress that had been made up

(*Continued on page 425*)



Engineering News

Another Land Speed Record Attempt

It has been announced that an attempt upon the world's land speed record is shortly to be undertaken by Mr. Kaye Don, the well-known racing motorist who holds the Brooklands flying lap record of 132.46 miles per hour. For this purpose a well-known motor manufacturing firm have constructed for him a car equipped with two engines of new design, each of which is claimed to develop 1,300 h.p. Details of this machine are not yet available, but it is stated that it will be capable of attaining a speed of 270 miles an hour. The attempt is to be made sometime next year at Daytona Beach, Florida, the scene of Major Segrave's recent successful attack on the land speed record. We hope to publish photographs and full details of Mr. Don's car.

* * * *

The Motor Vehicles of the World

According to the "*American Automobile*," which has recently taken a census of motor vehicles throughout the world, there were in operation on 1st January, 1929, a total of 31,929,952 vehicles of various types. This figure shows a gain of 8.6 per cent. over the number of vehicles in use on the corresponding date in 1928. In the United States the gain was 5 per cent., while the gain for the rest of the world taken collectively was 16.5 per cent. Approximately 589,900 motor vehicles were produced in Europe during the year, as against 574,000 during 1927. Great Britain heads the list for vehicles produced in Europe, with 215,000; while France comes a fairly close second with 200,000. The numbers of vehicles manufactured in other European countries were Germany 90,000; Italy 50,000; Czechoslovakia 12,000; Austria 9,000, and Belgium 7,000.

The total number of motor vehicles of all types registered in Great Britain was approximately 1,372,100; in France 1,108,900, and in Canada 1,061,800. The next two countries on the list were Germany and Australia with totals of 545,600 and 515,850 respectively.

* * * *

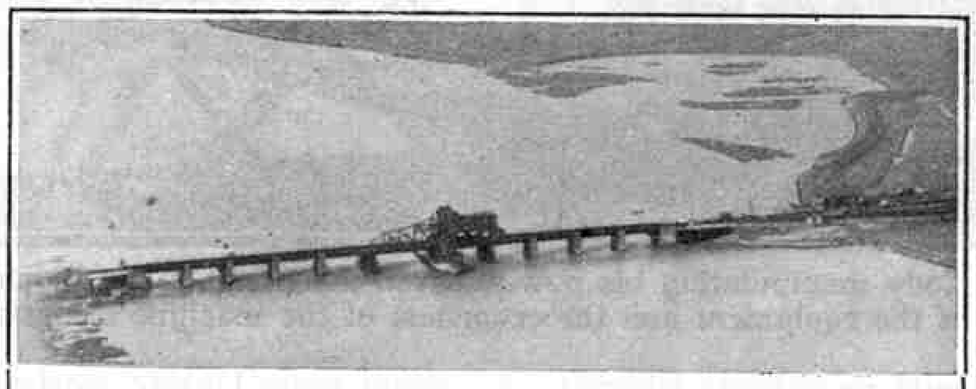
Sir Robert Ropner & Co., of West Hartlepool, have placed a contract with the Brand Powdered Fuel System, London, for the installation of pulverised-coal firing plant in a new steamer of 9,000 tons, which is at present under construction. It is claimed that the steamer will be the first British-built vessel to be driven entirely under the powdered fuel system.

Passenger Traffic on the North Atlantic

Passenger traffic on the North Atlantic during 1928 showed a marked increase over traffic in 1927, especially as regards that from Canadian ports, which increased 72 per cent., as compared with 28 per cent. for the ports of the United States. The total number of passengers carried was 1,227,047 in 1928 and 1,207,695 in 1927, which represents an increase of 19,352. Traffic to and from Canadian ports increased by 13,868, while that in and out of American ports increased by 5,474. This practically reverses the situation of 1927, when a comparison with figures for 1926 showed an increase of 70 per cent. for the United States, and an increase of only 30 per cent. for Canada.

* * * *

A serious dam burst recently occurred in Tasmania, when, after a period of excessive rainfall, the dam across the Cascade River, holding 750,000,000 gallons of water, burst. The deluge of water rushed down the Cascade Valley, washing away buildings in its path, and flooding a mine and numerous offices, houses and works.



The only communication between the Isle of Sheppey and the mainland is by means of King's Ferry Bridge over the River Swale.

Our two photographs, which are published by permission of the Southern Railway, show (above) the bridge closed and (below) the bridge with the span open to allow the passage of shipping.

Passing of 100-Year-Old Chimney

At Manchester recently a chimney stack 250 ft. in height and over 100 years of age was felled, to enable works in the neighbourhood to be extended. This stack was the highest in the South-West district of Lancashire, and the third highest in the whole of England.

There is always a certain element of risk attached to the felling of giant chimneys, and in this particular case an adjacent factory had a very narrow escape from being completely annihilated. It was decided by the firm in charge of operations to fell the stack in such a manner that the bricks would fall on a neighbouring piece of common land, thereby causing no danger to life or property. Unfortunately, however, when the bottom of the stack facing the common had been blown out, the remainder of the structure was unable to stand the strain. A large crack ran right up the chimney, which collapsed and piled up into a huge heap approximately 20 ft. in height and 60 ft. in diameter.

It is estimated that there were 2,000 tons of brickwork contained in the chimney. The first shot of the 12 that were fired blew a number of bricks over 100 yards, and when the chimney eventually crumpled up it completely demolished one wall of a room in the neighbouring works.

* * * *

Underground Canal 13 Miles in Length

Work has been commenced at Massachusetts, U.S.A., on an underground canal that will be one of the largest of its kind ever constructed. Its length is to be 13 miles, and its purpose is to augment the water supply for Worcester, Boston and district by carrying each day to the Wachuset reservoir the overflow from the Ware River after 85,000,000 gallons of water have passed. The tunnel will be 11 ft. in width and nearly 13 ft. in height, and it will follow a course through solid rock at a depth below ground varying from 200 ft. to 650 ft.

Eight working shafts have been sunk at various points along the course to be followed by the tunnel, and at present 1,000 men are employed on the undertaking. Special compressed air apparatus has been installed to drive away the foul air after blasting operations, in order to prevent the workmen from being overcome by fumes. The fallen rock is transported to the mouths of the shafts by locomotives propelled by electric storage batteries.

British Switchgear for Holland

A large and important switchgear contract has been awarded to the British Thomson-Houston Co. Ltd., of Rugby, by the Municipal Council of Rotterdam. The contract is for 25,000-volt three-phase, 50-cycle switchgear required in connection with a new power station three miles nearer the mouth of the Maas than the existing Schiehaven station, which has reached maximum capacity.

The installation will comprise 39 B.T.H. isolated phase equipments incorporating oil circuit breakers of the most modern construction, and having an interrupted capacity of 1,500,000 k.v.a. The ultimate capacity of the station is to be 252,000 k.w., and the switchgear will be arranged so that the equipment for each phase is housed in an entirely separate gas-proof building, on similar lines to the practice widely adopted in the United States for stations of large capacity.

The receipt of this order is very gratifying, as it was obtained in the face of severe competition from Continental manufacturers.

* * *

Work is proceeding rapidly on dredging operations in the St. Lawrence ship canal with the object of enabling liners with a draught of 32 ft. 6 in. to sail right up to Montreal.

* * * *

Bridge Cracked by Frost

During the extremely cold weather that was extensively prevalent early in this year, an unusual incident occurred at Breslau, the capital city of Silesia. A loud detonation awakened the inhabitants early one morning, and for a while its origin was a mystery. Eventually it was discovered that the severe frost had caused a bridge over the River Oder to contract, thus cracking it and forming a gap an inch in width across the whole bridge.

A somewhat similar incident occurred at Warrington, Lancashire, where the wood sets on a bridge across the River Mersey were forced up by the contraction of the iron structure beneath them.

* * * *

World's Most Luxurious Vessel

The new turbo-electric P. & O. liner, "*The Viceroy of India*," completed her maiden voyage, to Bombay, a short time ago. This vessel is equipped with electric propelling machinery and is probably the most up-to-date liner afloat. The whole of the main, and a large proportion of the auxiliary machinery, was constructed and erected by the British Thomson-Houston Co. Ltd. We hope to publish a detailed article on this fine vessel in some future issue of the magazine.

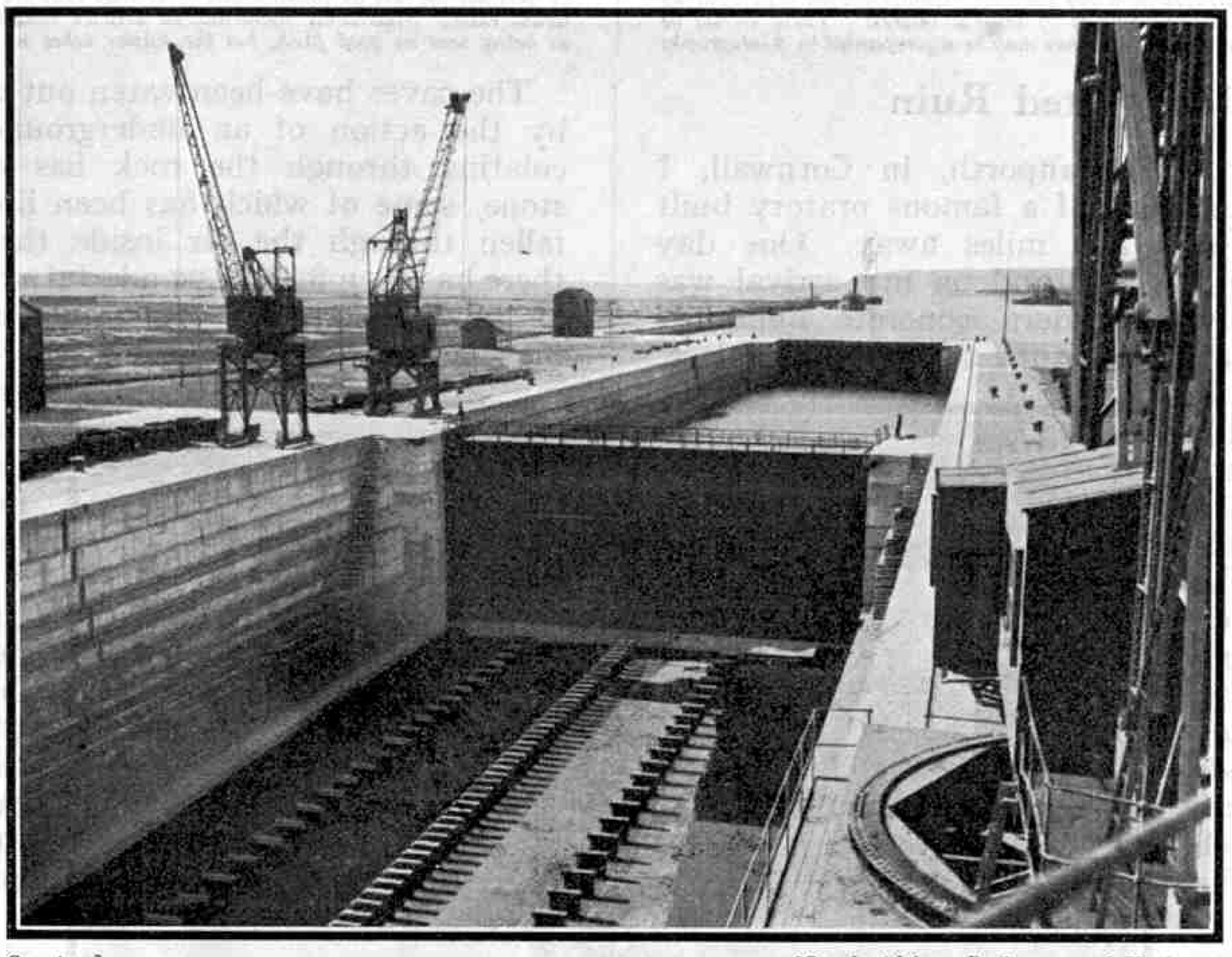
A 260-Mile Motor Speedway in Spain

The construction of a new 260-mile motor speedway in Spain is to be commenced very shortly. The road will stretch from San Sebastian to Madrid. Its average width will be 36 ft., but the curves will be rather wider and will be banked in a similar manner to racing tracks. A space of the road 6 ft. in width will be marked off in which drivers may park their cars as desired. It is proposed to construct at intervals of a few miles small huts where petrol, tyres, etc., may be purchased at any time. There will be no level crossings of any description, and where it is necessary for a road to cross the speedway, this will be carried either under by means of tunnels, or over by means of bridges.

* * * *

Electric "Eye" for Tunnel

A remarkable piece of apparatus, which may almost be termed an electric "eye," has been installed in the Holland vehicular tunnel under the Hudson River. The "eye" is used to count the number of vehicles that pass through the tunnel, and functions on somewhat similar principles to a fool-proof signalling device mentioned in the "Railway News" pages of the January "*M.M.*" In this device the interruption of a ray of light playing upon a selenium bridge caused the arm of a signal to be raised, and to stop a train following closely behind, until the preceding one had passed out of the section. In the electric "eye" an intense beam of light is made to play from an aperture in the roof of the tunnel upon a window let into the floor. As each motor car passes along it interrupts the beam for a short time. This causes a photo-electric cell placed just inside the window to actuate an electric relay, which in turn sets into operation a machine which automatically records the number of interruptions.



Courtesy] [*South African Railways and Harbours*

Graving Dock, Congella, Durban, showing outer chamber full, inner chamber empty. The Dock will accommodate two vessels at the same time

A Great Shipbuilding Catastrophe

One of the greatest disasters in the history of shipbuilding occurred when the new German Atlantic liner, the "*Europa*," was very largely destroyed by fire. At the time when the fire broke out the vessel was lying in the Hamburg Dockyard having the finishing touches put to her inner fittings. All available fire-fighting units were immediately rushed to the spot, but their efforts were practically futile. The whole of the interior of the vessel was burnt out and, in addition, considerable structural damage was done.

Readers will probably remember that the "*Europa*" was the sister ship of the "*Bremen*," and was in some respects the largest vessel in the world. Her length and breadth were respectively 938 ft. and 108.2 ft., as against the "*Majestic's*" corresponding dimensions of 912 ft. and 100 ft. On the other hand the gross tonnage of the "*Europa*" was only 46,000 tons as against the 56,261 tons of the "*Majestic*," this difference being accounted for by the fact that the "*Europa*" had a draught of 32.6 ft., while that of the "*Majestic*" is 39 ft.

The "*Europa*" and the "*Bremen*" were constructed by Germany with the intention of wresting the blue riband of the Atlantic from the Cunard liner "*Mauretania*." Their designed speed was 26½ knots, but it was anticipated that in actual operation both vessels would develop considerably greater speed. It is probable that work on the "*Bremen*" will be speeded up so that she will be ready for service earlier than had previously been necessary.

The "*Europa*" had accommodation for 2,200 passengers, in addition to a crew of about 1,000. Her maiden voyage had been announced to commence on 21st August, and a considerable number of passages had been booked.

* * * *

A New Bridge Across the Ouse

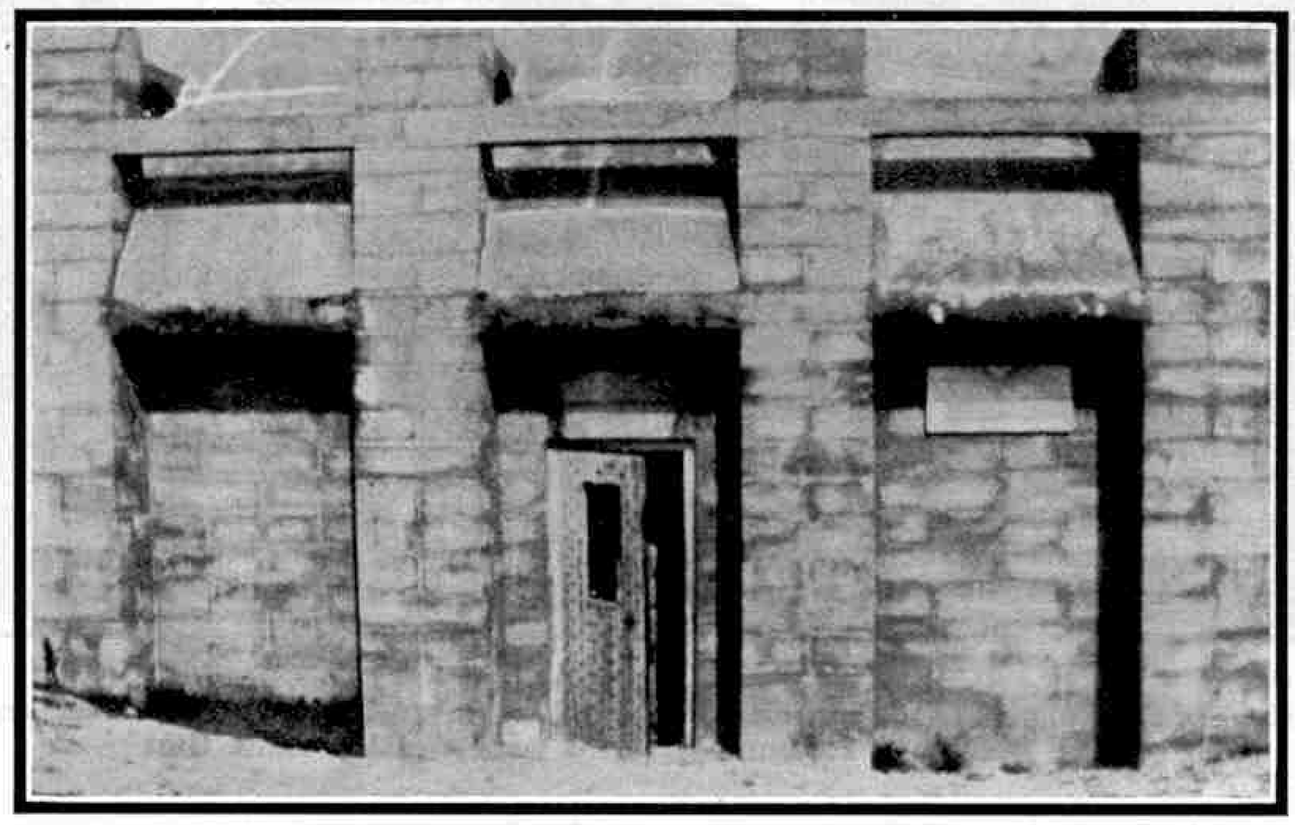
A large bridge spanning the River Ouse at Boothferry, near Goole, has now practically been completed, and is expected to be opened for traffic sometime this month. The bridge is 700 ft. in total length and possesses a movable span on the Howden side, 223 ft. in length. The swinging span is approximately 700 tons in weight, and is one of the largest spans of its type in the British Isles. There are in all five spans on the Goole side of the river, three of them being of the comparatively short length of 58 ft. each, and the remaining two 148 ft. in length. The bridge is supported on eight cylinders sunk to a depth of 44 ft., and carries a roadway 20 ft. in width, and two footpaths each 6 ft. in width.

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Well-protected Ruin

When on holiday at Perranporth, in Cornwall, I was informed that the ruins of a famous oratory built by St. Piran were only two miles away. One day I set out to walk to the site, and on my arrival was surprised to see only a modern concrete building! At first I thought that I had come to the wrong place, but as several people were entering the building, I followed them, to discover that the ruins had been completely enclosed in the modern building, which was only a protecting shell. Over the doorway of the ancient building I noticed three heads carved in the stonework, one of which represents that of the Saint himself.



Entrance to St. Piran's Oratory, which is protected by a concrete shell

St. Piran was an Irish missionary, who is supposed to have sailed across the intervening sea on a mill stone! Most of the Cornish people of that day were already Christians, and the task of converting the remainder was very easy. St. Piran built the shrine as a place of worship for his flock, and placed in it a circular altar slab brought over from Ireland. The shape of this slab is remarkable, as early English altar slabs were almost invariably rectangular.

On leaving the oratory I walked across the sandhills to see a cross that had been erected about half-a-mile away. This probably was built in the sixth or seventh century and is of interest chiefly because it has only three holes in the top whereas most crosses of this type have four. I concluded an interesting day's outing by walking back across the sandy beach to Perranporth.

S. A. TELFER (Slough).

Wonderful Caves in Australia

Recently I made an interesting excursion to the Jenolan Caves, one of the most remarkable of Australia's show places. They are in the mountainous country 136 miles west of Sydney, and the road by which I approached them passes through a tunnel in the mountain side. This was originally a rift in the rocks and has been widened out to accommodate a roadway. Its interior is so dark that motorists find it necessary to switch on their lights to enable them to traverse it in safety. This tunnel is 450 ft. in length.

The caves have been eaten out of soft limestone rock by the action of an underground river. Water percolating through the rock has dissolved away limestone, some of which has been liberated as drops have fallen through the air inside the caves. As a result there has been formed wonderful examples of the columns of limestone called stalactites and stalagmites, the first-named hanging from the roof while the latter grow up from the floor to meet them. They grow very slowly, the rate having been estimated at one inch in a thousand years, but columns of great thickness extend from the floor to the ceiling of the caves, showing that the underground river must have been at work for many thousands of years.

Many of these limestone formations have grown into the most fantastic shapes. In one of the series of connected caves that I visited there is an enormous mass of gigantic columns in which a resemblance may be traced to the organ loft and pulpit of a cathedral. Because of this the cave has been called the "*Cathedral,*" a name that is not inappropriate, for it is no less than 162 ft. in height! Electric lamps have been placed in tiny crevices in the walls of the "*Cathedral,*" and when lit up these give a wonderful representation of the effect of sunshine entering through the windows of an immense cathedral.

In some parts of the caves the stalactites are wonderfully coloured. This is due to the fact that the water forming them contains iron salts, and in some cases copper and manganese compounds. The coloured limestone columns have proved so attractive to tourists that it has been found necessary to put wire netting over them in order to prevent damage by the removal of pieces as souvenirs.

The caves are remarkably extensive and new ones are constantly being discovered. Their size may be judged from the fact that, although I explored only one of the twelve series that are open to the public, my journey occupied more than two hours. The caverns that are shown usually are electrically lighted, the necessary current being generated at a hydro-electric power station two miles away. Another interesting point is that the caves have been made as airtight as possible, because fresh air causes the limestone rock to disintegrate.

W. F. ROGERS (Sydney).

Elephant Processions in Kandy

People in all parts of the world take a great delight in processions to celebrate great occasions. In many countries they are of very elaborate character, but few of them are more interesting than the "Dalada Perehera," or procession of elephants, that may be seen every summer in the streets of Kandy, the capital of Ceylon. The festival lasts twelve days, and for three hours on each of them a long procession of these great animals winds its way through the streets.

The story of the origin of the procession is interesting. Long ago, when Ceylon was an independent country, one of its kings was in the habit of disguising himself and walking through the streets of his capital—the now ruined city of Anuradhapura. His purpose was to see for himself the manner in which his people lived. On one of his walks he chanced to hear an old woman crying and wailing. On inquiry he learned that her two sons were among 12,000 Sinhalese who had been carried away as captives by Tamil invaders from Southern India, and he was so moved by her grief that he determined to rescue them. With a great army he crossed to the mainland, defeated the Tamils in battle and restored the 12,000 captives to their native country.

Devil dancers in the elephant procession at Kandy, Ceylon. Their contortions are supposed to drive away evil spirits

It was to celebrate the triumphant return of the captives that the procession was first held, and it has been carried on without a break ever since. Usually the event is held in July or August. Shops and houses are gaily decorated, and the country people from far and wide pour into the town in order to see the processions, and to enjoy themselves on the merry-go-rounds and at the various shows that invariably form part of the attractions.

The procession is composed of groups of elephants from the many Buddhist temples in Kandy. The biggest animal in each group carries a specially constructed howdah in which is some relic or other of Buddha, the founder of the religion followed by the Sinhalese. Even the Sacred Tooth of Buddha himself figures in the procession. This is one of the most treasured relics in the East, and the temple in which it is kept is a shrine that is visited by thousands of Buddhist pilgrims. The honour of carrying the precious tooth is always given to the finest elephant in the procession.

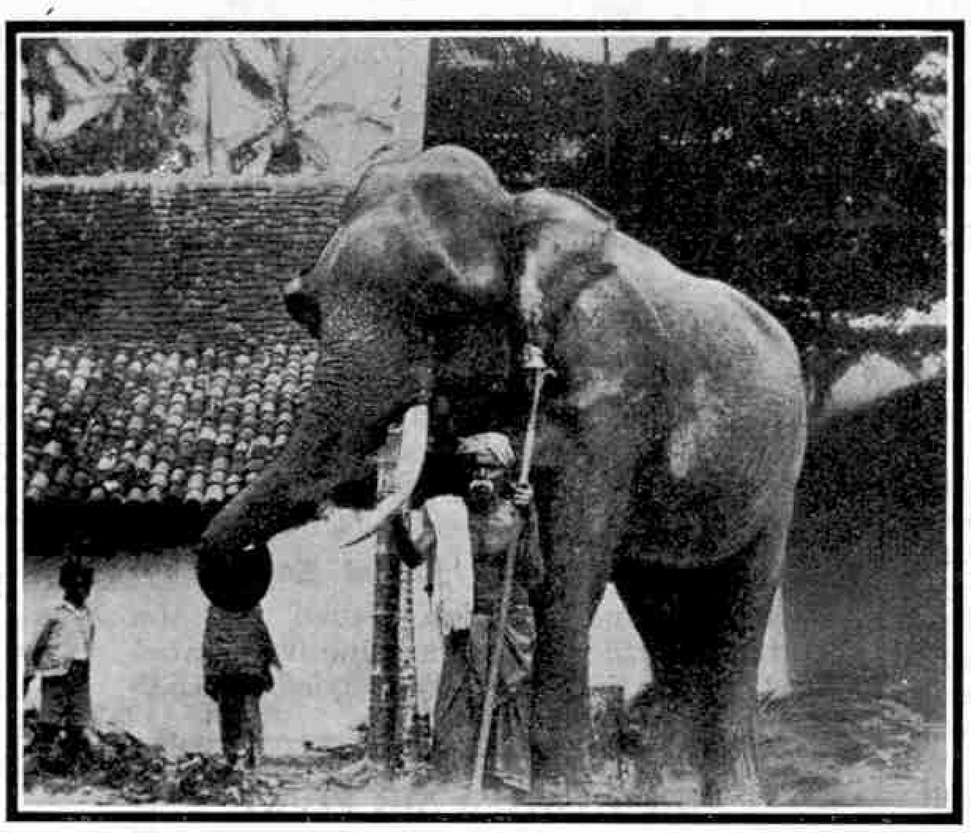
Between 60 and 80 elephants figure in the processions. The first carries the Charter establishing the right to hold the procession, and gaily clad parties of Sinhalese ride on the remaining animals. Each group is followed by "devil dancers," whose wild gyrations are supposed to drive off evil spirits.

The animals move off at 9 o'clock in the evening and parade the streets until midnight. Hundreds of torches are used to illuminate the road, and vast crowds line the route. The only variation comes on the last day, when the procession starts at noon and ends at 3 o'clock in the afternoon.

During the twelve days of the celebrations the town is crowded from morning till evening, and betel-nut sellers, coffee vendors and sweetmeat men reap a rich harvest.

To a visitor the strangest thing is the sudden manner in which the proceedings end. Immediately the procession of the last day has passed the people disperse, and by 5 o'clock the streets are practically deserted. Life in Kandy then resumes its ordinary course, and very little happens to disturb its peace and quietness until the processions of the following year are due.

B. K. Billimoria
(Kandy, Ceylon).



The above photograph shows the elephant that carries the Sacred Tooth of Buddha. This honourable task is always given to the finest animal in the procession

Queer Insect Pets

Very few boys keep pets as remarkable as mine. Some time ago a friend gave me eight young stick insects that he had obtained from the East. I had some difficulty in finding them suitable quarters, but eventually I housed them in a glass case that had formerly been used for protecting a clock. In the wooden floor I drilled several holes, into which I stuck short twigs of privet in order to serve them as food.

The youngsters grew quickly on this cheap diet; so quickly, in fact, that they became too big for their skins! One morning I was rather alarmed to find the empty skin of an insect firmly clasped to a leaf. I was reassured when I found nearby a bright green insect nearly double the size of the brown one that I had seen on the previous night. The insects eat very greedily when they are growing, and every three weeks their skins become too tight to hold them. Then they merely wriggle backward out of their old coats, and appear in more comfortable garments that permit them to gorge freely once more. The change is made about five times while the insects are growing to their full size.

S. A. Bevan (London).

Fairey Long-Range Monoplane

Further particulars are now available of the long-range monoplane that has been constructed for the Air Ministry by the Fairey Aviation Company, and about which a brief reference was made in our January issue. The machine has been made specially for a British attempt upon the world's non-stop distance record, and some idea of its dimensions is obtained from the fact that the wing span is 82 ft. An extremely good streamlining effect has been achieved and the machine is remarkable for the absence of exterior wires and spars. Another interesting feature is the position of the radiator. This has not been placed in the front of the machine as is the usual custom, but is on the underside of the fuselage immediately at the rear of the undercarriage. This position has been chosen as the best one possible as a result of a series of exhaustive wind-tunnel experiments. The radiator may be raised or lowered as desired, in accordance with the conditions obtaining at any particular time during the flight.

The Fairey Long-Range Monoplane fitted with Napier "Lion" engine

Strict secrecy is still being maintained with regard to the more important details of the machine and it is not yet known what quantity of petrol can be carried in the seven tanks with which the machine is equipped. Neither is it known when and where the flight will be made, although two pilots have been selected for the machine and have already undertaken a number of trial flights.

The comfort of the pilots has been well considered, and pneumatic upholstery and a pneumatic bed have been provided for them. An extremely interesting gadget that is fitted suggests that even pilots of long-range monoplanes are only human. It consists of a hooter that automatically sounds a piercing blast in the pilot's ear if he should happen to fall asleep and allow the machine to get off its course! The engine fitted is a Napier type X1 "Lion" developing a maximum of approximately 530 h.p.

* * * *

Experiments on a new twin propeller unit are being conducted in America. The unit consists essentially of two propellers, placed side by side, that rotate in opposite directions. It is claimed that this arrangement eliminates all torque.

"*Golden Arrow's*" Aircraft Features

It is of interest to note that aviation played quite a considerable part in the breaking of the world's land speed record at Daytona Beach, by Major Segrave, who is an ex-R.A.F. officer. The engine with which his "*Golden Arrow*" was fitted, was a Napier racing engine similar to the type specially designed for the British machines in the 1927 Schneider Trophy, while the radiators were special adaptations of the standard wing-radiators fitted on racing aircraft constructed by the Gloster Aircraft Co. Ltd. The sparking plugs used were also similar to those specially made for the last Schneider Trophy.

* * * *

Reliability of the Jupiter Engine

In a communication issued by the Director of the K.L.M. air line it is stated that during 1928 the line carried out 535 return journeys between Paris and Amsterdam with their Jupiter-engined Fokker machines. Throughout the entire year no journey was cancelled for technical reasons, and only nine departures from Paris were cancelled owing to bad weather. During the summer season, from the 15th April to the end of September, a service was run three times daily in each direction without having either a reserve machine or a reserve engine at Le Bourget aerodrome.

THIS MONTH'S AIR STORY

Pilot (to very air-sick passenger, after first flight): "Well, how do you feel now?"

Passenger (dolefully): "Absolutely down and out!"

The World's Largest Airship Shed

A giant airship shed that is now being erected near Akron, Ohio, U.S.A., will be the largest airship shed in the world, easily eclipsing the Cardington and Karachi sheds previously mentioned in these pages. The cost of constructing this building, which is expected to be ready for service this year, is estimated at £625,000.

The shed has been built to house during their construction two great airships for the United States Navy. These ships will each be capable of carrying 100 people, together with six aeroplanes; and they will be constructed in such a manner that the aeroplanes will be able to leave or return to the ship without any reduction in its cruising speed. Each airship will be 785 ft. in length and 133 ft. in diameter, and will have a capacity of 6,500,000 cu. ft. of helium. The estimated cost of the two vessels is £2,000,000.

The dimensions of the shed are, length 1,200 ft.; width 325 ft.; and height 200 ft. An interesting feature of its construction is the entire absence of any internal supporting pillars, leaving the floor space of 389,000 sq. ft. entirely unobstructed.

Some idea of the size of this shed may be gained from the fact that if the famous Woolworth building were laid on its side and pushed inside the shed, another structure half the size of that building could still be accommodated!

* * * *

An Interesting New Biplane

The Academic Flying Club at Darmstadt have recently carried out a series of experiments that have resulted in the construction of a biplane in which the need for the numerous stays usually so much in evidence on biplanes has been overcome. The machine put up an excellent performance during its trials, achieving a maximum speed of 124 m.p.h. It also showed remarkable climbing powers by attaining a height of nearly 3,300 ft. in three minutes. The machine requires a run of only 98 ft. in which to take off, and it is stated to possess unusually good steering qualities.

The wing span is 23 ft. and the overall length 19 ft. 7 in. The flying radius of the biplane is 310 miles.

Britain's First Empire Air Service

The first Empire Air Service to Karachi left the Air Port of London, Croydon, on 30th March last, carrying Sir Samuel Hoare, Air Minister; Air Vice-Marshal Sir Vyell Vyvyan, and Major Bullock, secretary to Sir Samuel Hoare, in addition to a large amount of mail. Sir Vyell Vyvyan was the only passenger to proceed all the way to Karachi, as Sir Samuel and his secretary only travelled as far as Alexandria. Although the service was delayed for some considerable time by a sand storm and adverse winds, the triple-engined "Hercules" machines flying the final stage of the route from Alexandria to Karachi, were only three hours late at the completion of the historic journey of 5,000 miles.

The service is being run by Imperial Airways Ltd., with their usual thoroughness in safety measures. During the whole of the flying time the machines engaged are in wireless communication with the chief stations along the route.

The first return journey from Karachi to London left Karachi on the 7th April, carrying Sir Vyell Vyvyan, Sir Geoffrey Salmond, Air Officer Commanding India, and the Chairman of Imperial Airways, Viscount Chetwynd, together with his daughter and his private secretary. It is interesting to note that Miss Chetwynd is the first woman to travel from India to London by air. Over 15,000 letters were carried on the India-London journey, and the landing was made at Croydon a few minutes ahead of the scheduled time.

* * * *

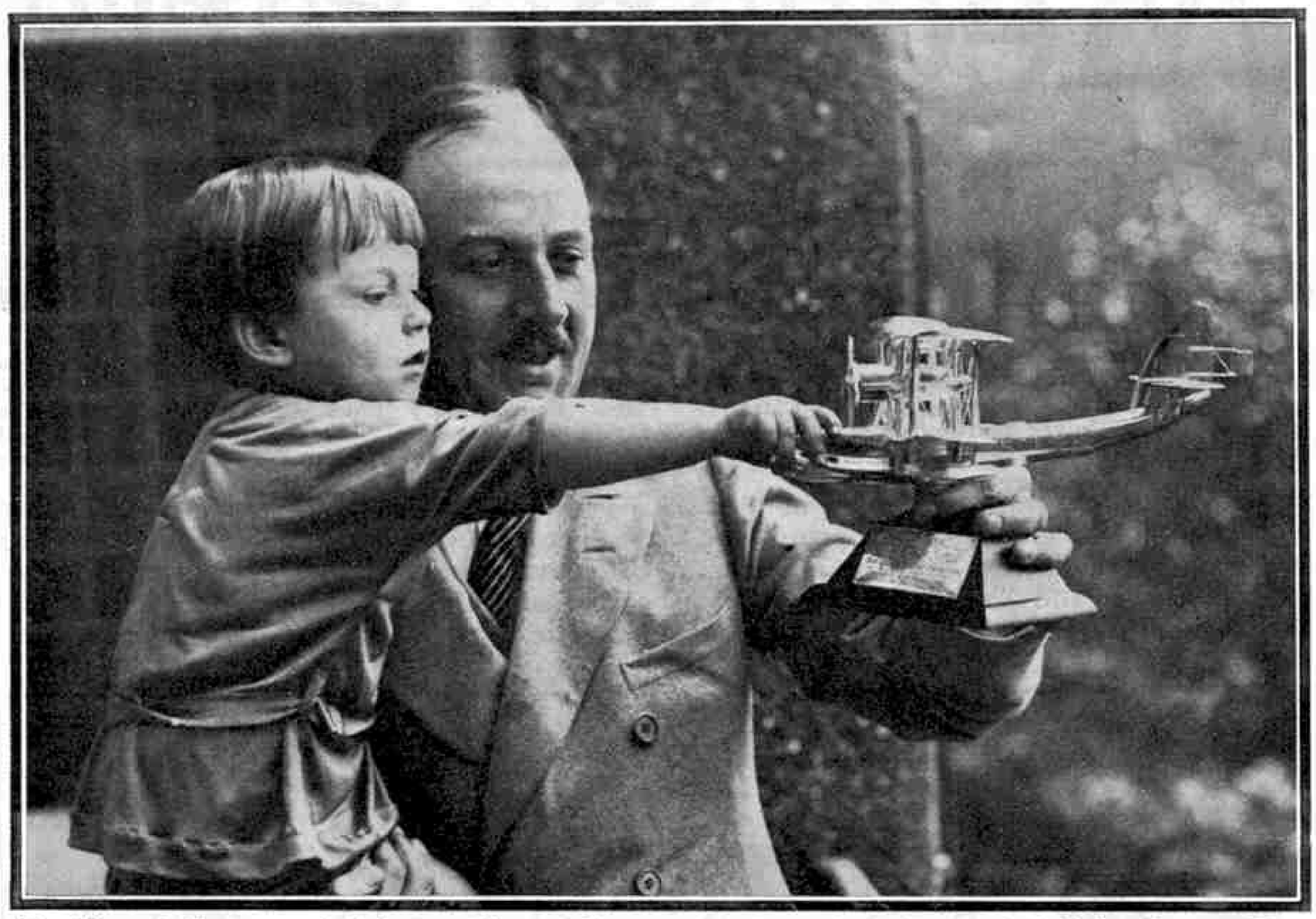
Manchester's Temporary Aerodrome

Although work on the Manchester Municipal Aerodrome at Chat Moss is being carried on with the utmost despatch, the Manchester Aerodrome Committee were so impatient to commence operations right away that a temporary aerodrome has been made at Wythenshaw. At the opening of the aerodrome, Captain A.K. Kingwill interrupted a journey from London to Glasgow in order to call at this, the first civic air port in England. During his stay he gave "joy-rides" to a number of members of the Aerodrome Committee.

The permanent aerodrome at Chat Moss is expected to be ready by next October at the latest, but until then the Northern Air Lines Ltd., will make use of the temporary aerodrome which has now received an official license. The preliminary services are only to be of an air-taxi nature.

Air Ministry's Airport Scheme

The Air Ministry have at present under consideration a scheme for the establishment of a number of marine air ports where the luggage of travellers arriving by flying boats could be examined for contraband by Customs Officers. There are at present marine air ports at Southampton and Dover, and it is intended to establish others at London, Liverpool, Hull, Plymouth, Middlesbrough, Newcastle-on-Tyne, Greenock, Belfast and Swansea.



Sir Alan Cobham explaining to his small son the mysteries of a model flying boat. The model is in silver, and was presented to Sir Alan by some of his admirers

IMPERIAL AIRWAYS AIRCRAFT

In response to repeated requests we publish below a complete list of the aircraft owned by Imperial Airways Limited. The list gives the identification letters, the type names, and the routes over which the machines usually operate.

Identification Letters.	Type Names.	Routes.
G-EBLO, G-EBLF, G-EBOZ	Armstrong Whitworth "Argosy"	Silver Wing Service, London-Paris and return flights.
G-EBMT, G-EBMK, G-EBMM	Handley Page "W.10"	Any route as required but mainly London-Paris; London-Paris-Basle; London-Brussels-Cologne, and return flights.
G-EBBH, G-EBBI	Handley Page "W.8"	do. do.
G-EBIX	Handley Page "W.8.F"	do. do.
G-EBLE	Handley Page "W.9"	do. do.
G-EBFP	De Havilland "50"	Special Hire Work.
G-EBVG, G-EBVH, G-EBGR	Short Bros. "City of Alexandria" class all-metal flying boats	Mediterranean section London-Karachi Empire Air Route.
G-EBMX, G-EBMY, G-EBMW, G-EBMZ, G-EBNA	De Havilland "Hercules"	Cairo-Baghdad-Basra; Cairo-Baghdad-Basra-Karachi, and return flights.

The High-Speed Flight, from which Britain's representative team for this year's Schneider Contest will be chosen, has been stationed at Felixstowe for some time, and has carried out a number of practice flights in the Napier-engined Supermarine machines constructed for the 1927 Contest.

Air Tourists' Alarming Experience

An exciting experience recently befell Vicomte and Vicomtesse Jacques de Sibour, who commenced a flight round the world in September of last year, and expect to arrive back at Stag Lane aerodrome next month.

When flying over Arabia their machine developed engine trouble, and they were forced to descend. Unfortunately the failure occurred near a battle that was taking place between Royal Air Force machines and Arab raiders, and immediately the machine touched the ground the Arabs dashed up, intending to make its occupants captive. To prevent this, the R.A.F. machines set up a barrage of bullets round the machine, so that it was impossible for the Arabs to approach. This disturbing state of affairs continued for over half an hour before the raiders were dispersed and an Army lorry was able to rescue the tourists and their machine.

* * *

Training Anti-Aircraft Gunners

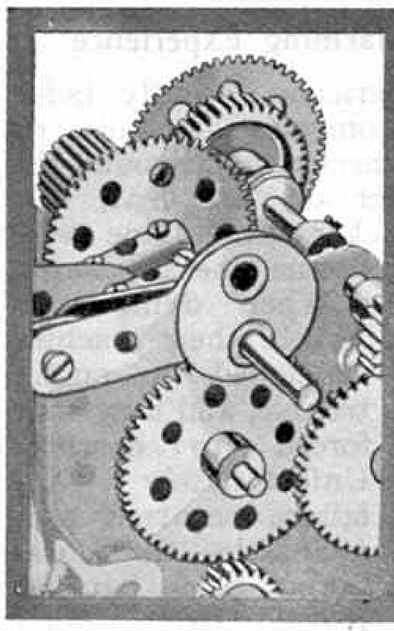
The latest method of training anti-aircraft gunners in America is by means of gliders. The gliders are carried up by standard army aeroplanes and launched into the air at a height of from 8,000 to 10,000 ft. Previous to this the controls in the glider have been set to ensure that the descent to earth is as realistic as possible, so that the gunners are shooting at a target closely resembling an enemy machine in actual warfare. In the event of any of the gliders falling into lakes or the sea, specially designed high-speed motor boats will be available to recover them before they sink.

* * * *

Atlantic Flown Again

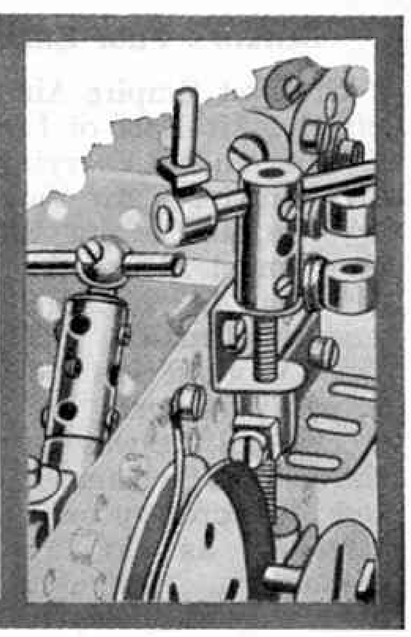
Two Spanish airmen, Captains Jiminez and Inglesias, have succeeded in flying the Atlantic Ocean once again. The aviators left Seville in a machine named the "*Jesus del Gran Poder,*" and flew a distance of 4,190 miles to Bahia, a seaport on the Brazilian Coast. Their original intention had been to proceed as far as Rio de Janeiro, but as the fuel supply was almost exhausted they decided to land at Bahia.

The airmen were flying for a total time of 42 hours, 40 minutes, but the flight does not constitute a record, being 131 miles shorter than the flight from Seville to Rio de Janeiro made by the Italian airmen, Captain Arturo Ferrarin and Major Del Prete. The "*Jesus del Gran Poder*" is the same machine in which the Spaniards flew from Seville to Karachi last year, except for a new engine.



HOW TO USE Meccano Parts

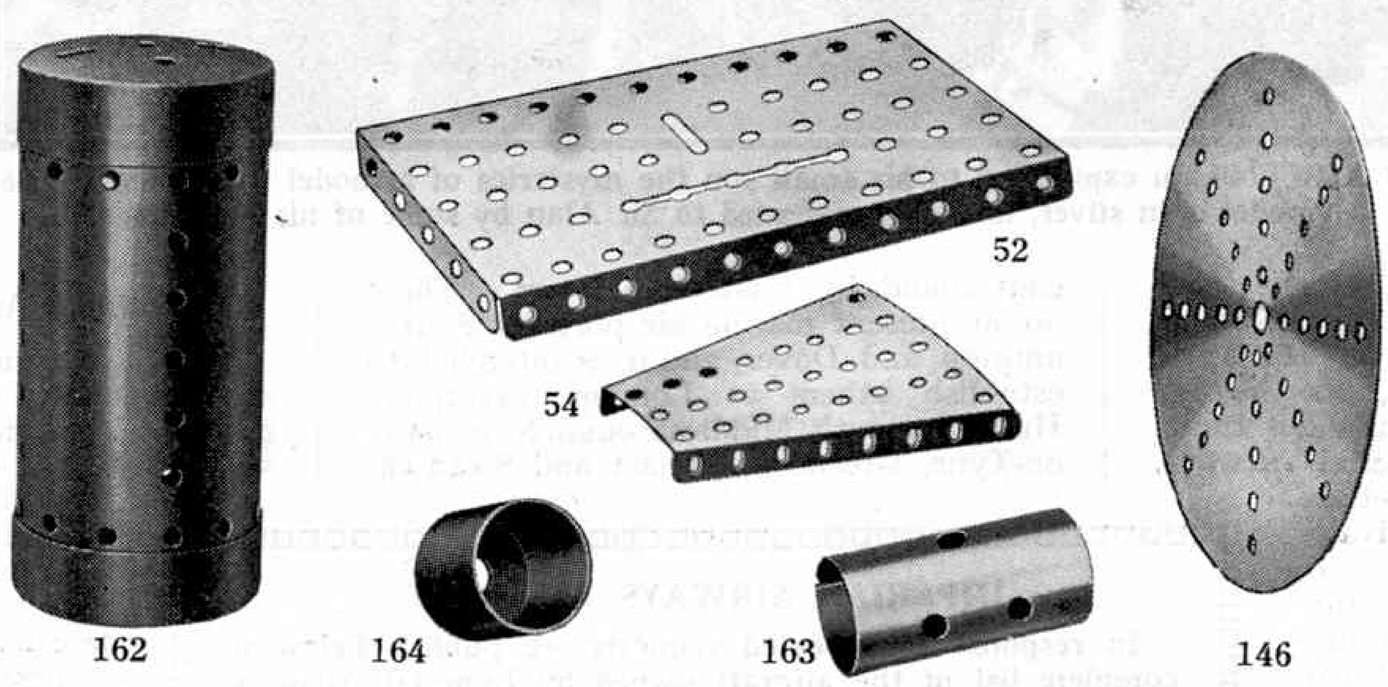
IV.—PLATES, etc. (CLASS D)



For the purpose of this series of articles we have grouped all the Meccano parts into two main sections, termed the Structural and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping is as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools and Literature. Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical Parts; Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

IN Classes A and B we described the more important uses of the Meccano Strips and Girders, which are designed primarily for building the framework or "outlines" of Meccano models, and in Class C we dealt with Brackets and Trunnions, etc., the chief function of which is the forming of connecting links between the larger parts. Class D, which is the subject of this month's article, comprises the Meccano Plates, Boilers, and associate parts. These are intended principally for "filling in" the framework of models and for building gear boxes, floors, roofs, etc. Of course, certain parts, such as the Circular Plates, Chimney Adaptor, etc., included in this Class have other very different uses.

Parts in Class D: Plates, Boilers, etc.



The following is a complete list of parts in Class D. Some of the parts are illustrated above.

Parts No.			Price	Parts No.			Price
			s. d.				s. d.
52	Perforated Flanged Plates, $5\frac{1}{2}'' \times 2\frac{1}{2}''$	each	0 5	76	Triangular Plates, $2\frac{1}{2}''$	... each	0 2
53	Perforated Flanged Plates, $3\frac{1}{2}'' \times 2\frac{1}{2}''$	,,	0 3	77	Triangular Plates, 1"	... ,,	0 1
52a	Flat Plates, $5\frac{1}{2}'' \times 3\frac{1}{2}''$	,,	0 5	146	Circular Plates, 6"	... ,,	1 0
53a	Flat Plates, $4\frac{1}{2}'' \times 2\frac{1}{2}''$	,,	0 3	162	Boiler, Complete with Ends ...	... ,,	1 0
70	Flat Plates, $5\frac{1}{2}'' \times 2\frac{1}{2}''$	,,	0 4	162a	Boiler Ends	... ,,	0 3
72	Flat Plates, $2\frac{1}{2}'' \times 2\frac{1}{2}''$	,,	0 2	163	Sleeve Pieces	... pair	0 6
54	Perforated Flanged Sector Plates ...	,,	0 3	164	Chimney Adaptors	... each	0 2

Flanged and Flat Plates

The Perforated Flanged Plates are in two sizes, $5\frac{1}{2}'' \times 2\frac{1}{2}''$ and $3\frac{1}{2}'' \times 2\frac{1}{2}''$ (parts Nos. 52 and 53 respectively). The former has flanges on all four sides, whilst the latter is flanged on only two sides. Part No. 52 is used to a large extent as a base for small models, and in the construction of work-tables, platforms and sides of gear boxes, etc. In addition to the usual perforations it has a slot 2" long and a hole $\frac{5}{8}'' \times 3/16''$ near its centre. The purpose of the slot is to receive the blade of a Circular Saw when the latter is mounted beneath the Plate, whilst the elongated hole is intended to facilitate the adjustment of the Saw guide piece.

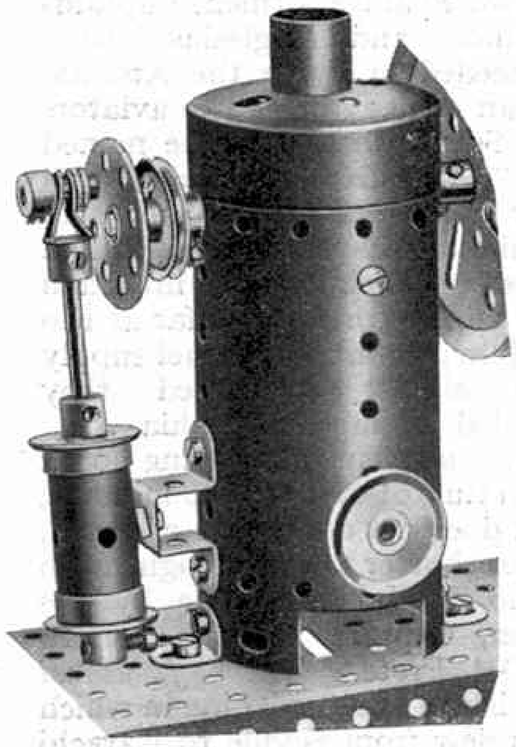


Fig. 1

Fig. 3 shows the Plate incorporated in a model saw bench. The blade of the Saw, which is secured to the Sprocket Wheel shaft, can just be seen above the Angle Girder that forms the guide piece. This Girder is held in place by the Collar shown, and the latter is secured on to the shank of a bolt passed through the elongated hole in the Plate.

The slot and hole increase the adaptability of the Plate in several other ways. If the Plate is used as the side of a gear box, for example, a change-gear lever may be arranged to work in the slot, and the inner end of the lever may then be connected direct to the shaft, clutch member or gear that it controls.

There are four sizes of Flat Plates, i.e., $5\frac{1}{2}'' \times 3\frac{1}{2}''$, $5\frac{1}{2}'' \times 2\frac{1}{2}''$, $4\frac{1}{2}'' \times 2\frac{1}{2}''$, and $2\frac{1}{2}'' \times 2\frac{1}{2}''$. If plates are required larger than these it is of course a simple matter to build them up by joining two or three Flat Plates together. Fig. 17 shows two of No. 52a connected together to form a platform measuring $6\frac{1}{2}'' \times 5\frac{1}{2}''$. The various types of Flat Plate, used in conjunction with the Flanged Plates, etc., enable covered structures of all kinds to be built-up speedily and in a sturdy and realistic manner.

The Sector Plate

The Sector Plate (part No. 54) is an extremely useful accessory. It measures $2\frac{1}{2}''$ across at its widest end and tapers down to $1\frac{1}{2}''$ at its other end, and its sides are provided with flanges which are punched with slightly elongated holes. The tapered shape so obtained enables the part to be used in many structures and mechanisms where it would be impossible to achieve similar results from other parts. Fig. 9 shows two Sector Plates used to form the movable receptacle in a Meccano model of a foundry ladle. Fig. 8 illustrates a Sector Plate employed to form the bonnet of a motor car, and Figs. 12 and 16 indicate two ways in which the part can be used with great advantage in building-up bases or supports for machinery.

When a Sector Plate is bolted by one of its flanges to a Girder or other part, its other flange and the rows of holes punched in its face lie at an angle to the part, and this fact proves advantageous in numerous cases. In Fig. 10, for example, a Sector Plate is shown secured to the base of a rotating crane. Another is bolted to the opposite side of the

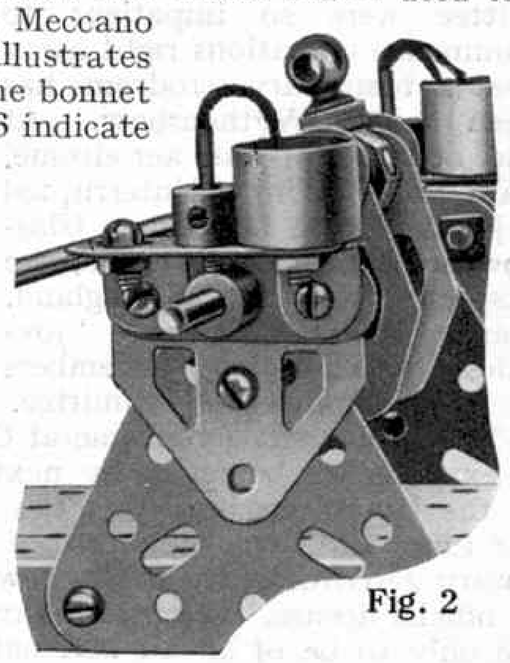


Fig. 2

base, so that Axle Rods journalled in Angle Brackets bolted to the Sector Plates are disposed radially to a fixed point near the rear of the model. These Rods carry the travelling wheels. Hence the model is capable of rotating completely about the fixed point.

Parts No. 76 and 77, 2½″ and 1″ Triangular Plates, are intended principally for use as supports for journal bearings, as shown in Figs. 2, 13 and 15, but they have numerous other important uses. In Fig. 7 for example, four 2½″ Triangular Plates form the sides of a grab and in Fig. 11 two are used in the construction of a pulley block.

An important feature of the 1″ Triangular Plate is the fact that it enables ¼″ distances to be obtained, which is not always easy with the ordinary parts perforated at intervals of ½″. Fig. 14 shows two of these parts attached to the rear of the Meccano Traction Engine, to receive the end of the drawbar attached to a trailer. The rear of the Traction Engine is 3″ wide (six holes); hence it would not be possible to attach the drawbar pin direct to one of the holes in the rear plate, since it would be out of centre. By attaching two 1″ Triangular Plates as shown, however, and securing the pin to their protruding ends, the drawbar is connected centrally.

The Circular Plates (part No. 146) may be employed as large flywheels or turntables, etc., or as circular fixed bases for machinery. Another important use for them is found in the construction of driving wheels for giant Meccano locomotives. Fig. 5 shows one of the six driving wheels of the Baltic Tank Engine. It consists of a Circular Plate having a Hub Disc bolted to it to form the flange or "tread." The heads of the rails on which this type of wheel is intended to run should be at least ¼″ wide, and if the rails are built-up from Angle Girders as in the illustration, the extra width can be obtained by fixing ordinary Strips to the inner sides of the vertical Girder flanges.

The Circular Plate has a large perforation at its centre and the boss of a wheel may be slipped through this if desired. The Plate is secured to an Axle Rod by first bolting it to a Bush Wheel or similar part mounted on the Rod.

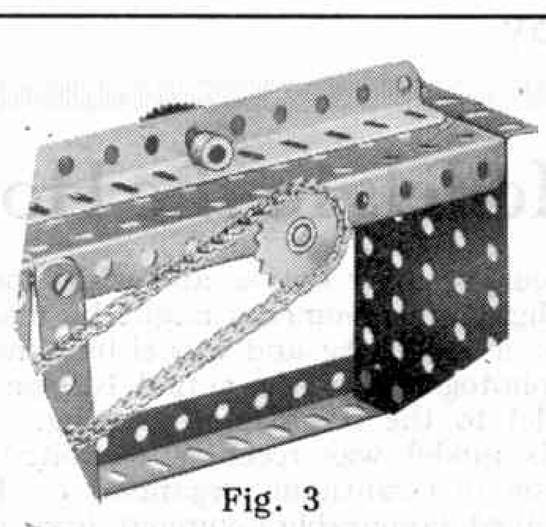


Fig. 3

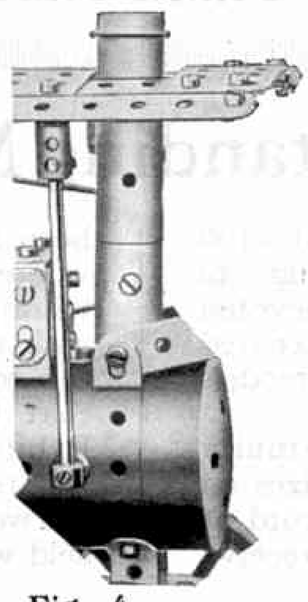


Fig. 4

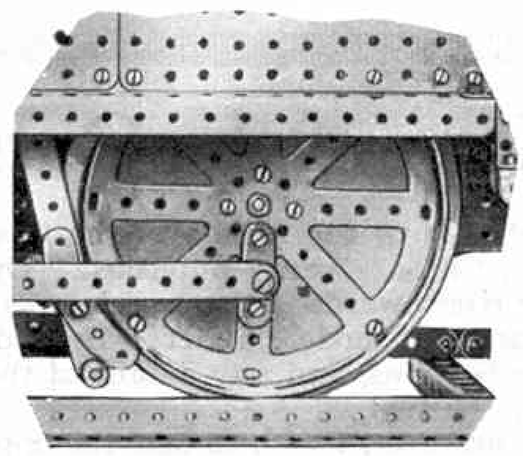


Fig. 5

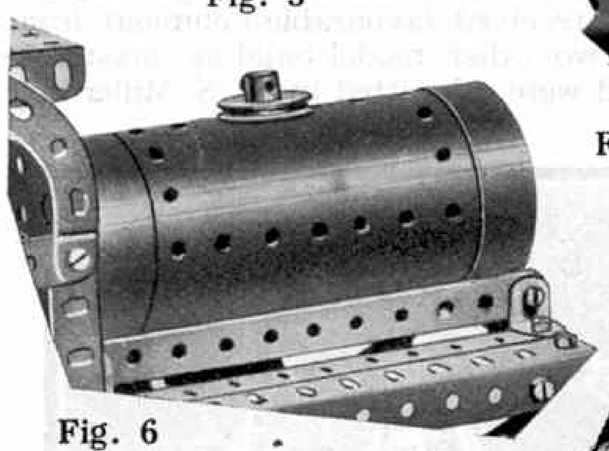


Fig. 6

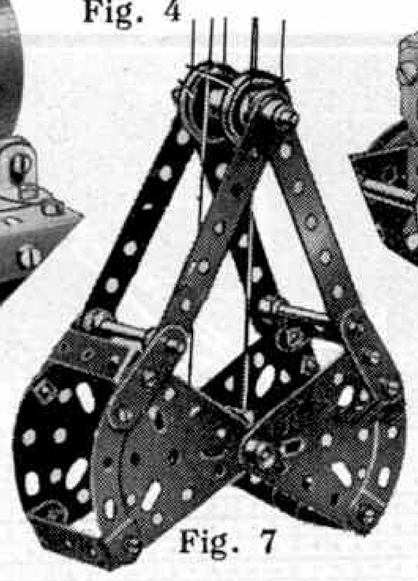


Fig. 7

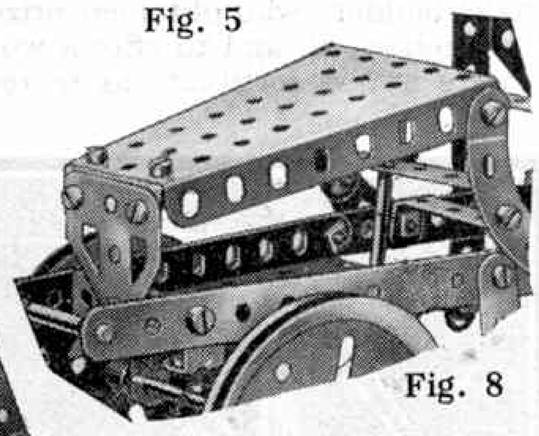


Fig. 8

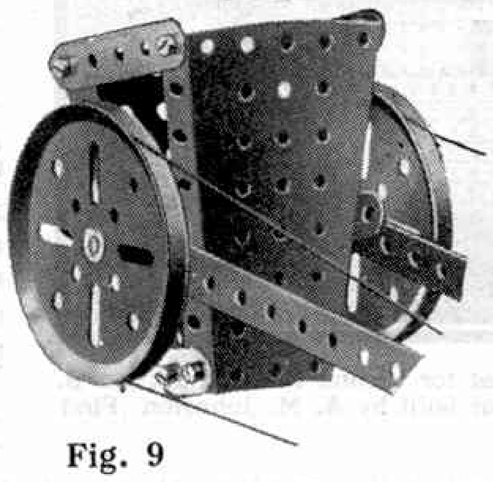


Fig. 9

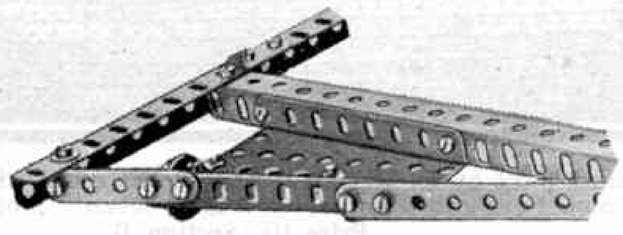


Fig. 10

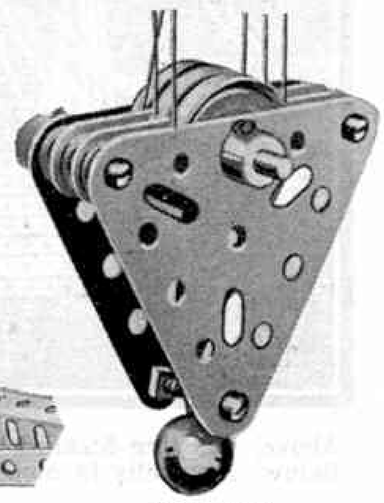


Fig. 11

Boilers, Sleeve Pieces, and Chimney Adaptors

The Meccano Boiler is perforated with the standard equidistant holes and can be incorporated in Meccano locomotives, stationary engines and numerous other models of a similar type. It measures 4¾″ by 2″, and is fitted at each end with a movable cap or Boiler End. With one Boiler End removed it may be incorporated in a model as a vertical boiler, or with both ends closed it will serve equally well as a horizontal boiler. Fig. 1 shows it in the former capacity, whilst in Fig. 6 it is seen in the horizontal position. In the latter illustration it represents the rear portion of a model tank lorry. When employed to represent a steam boiler, suitable boiler fittings can easily be improvised from existing parts. A very different function of the part is its use as a cylindrical supporting column for machinery of various kinds.

The Sleeve Pieces (part No. 163) are intended primarily for use in the construction of cylinders and chimneys. To form a complete cylinder, two ¾″ Flanged Wheels should be pushed over the ends of a Sleeve Piece as shown in Fig. 1. The Sleeve Piece may be secured in position by bolts inserted in the holes punched round its centre. In the example illustrated the cylinder is of the oscillating type and is pivoted to the Double Bent Strip by means of a bolt that is secured to the Sleeve Piece by two nuts, as in Standard Mechanism No. 262.

When used as a chimney the Sleeve Piece may be secured to a model by means of a ¾″ Flanged Wheel clamped over one end or by a Chimney Adaptor (part No. 164). The diameter of the latter is such that it will make a firm fit when pushed into one end of the Sleeve Piece. In building up longer chimneys, two Sleeve Pieces may be connected together by pushing them over opposite ends of a Chimney Adaptor, but a more rigid and efficient method is that adopted in the chimney shown in Fig. 4. This consists of three Sleeve Pieces placed end to end with the centre Sleeve Piece overlapping each of the other two by ⅜″. A 3½″ Rod passed lengthwise through the centre of the three Sleeve Pieces carries at one end a ¾″ Flanged Wheel that forms the top of the chimney. The top and bottom Sleeve Pieces are held in place by means of bolts passed

(Continued on page 425)

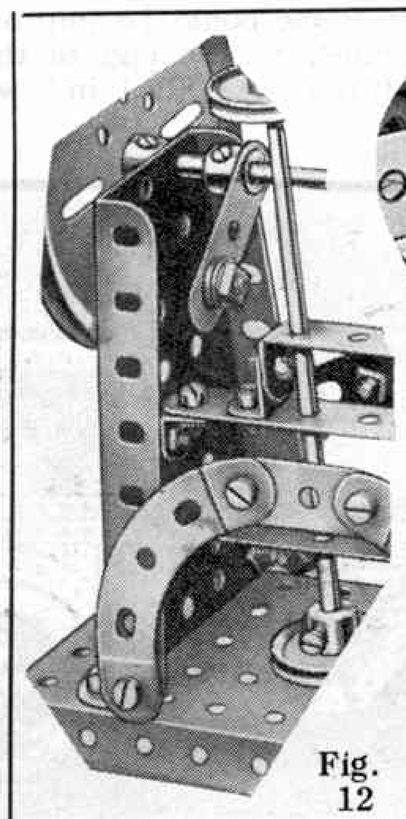


Fig. 12

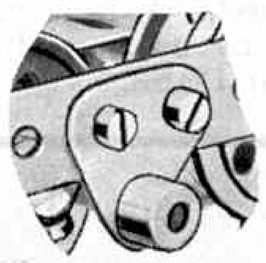


Fig. 13

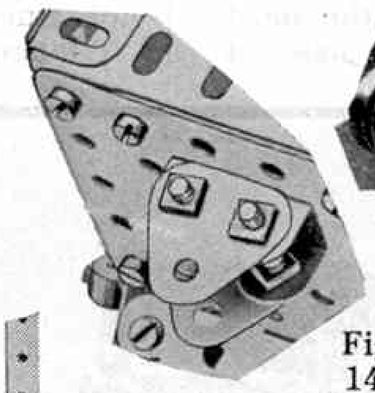


Fig. 14

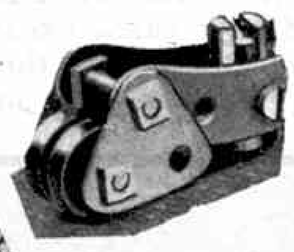


Fig. 15

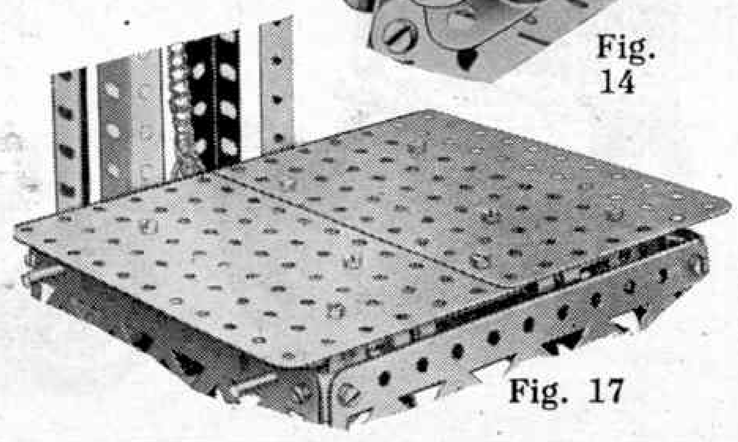


Fig. 17

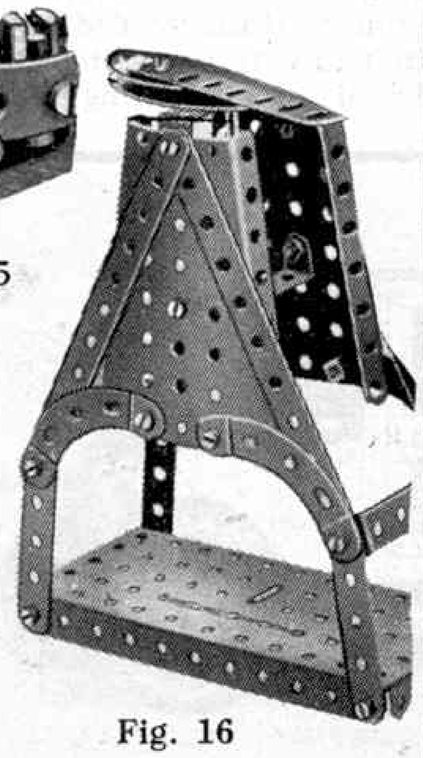


Fig. 16

An Interesting Commentary on the Results of the £100 Model-Building Competition

By Frank Hornby

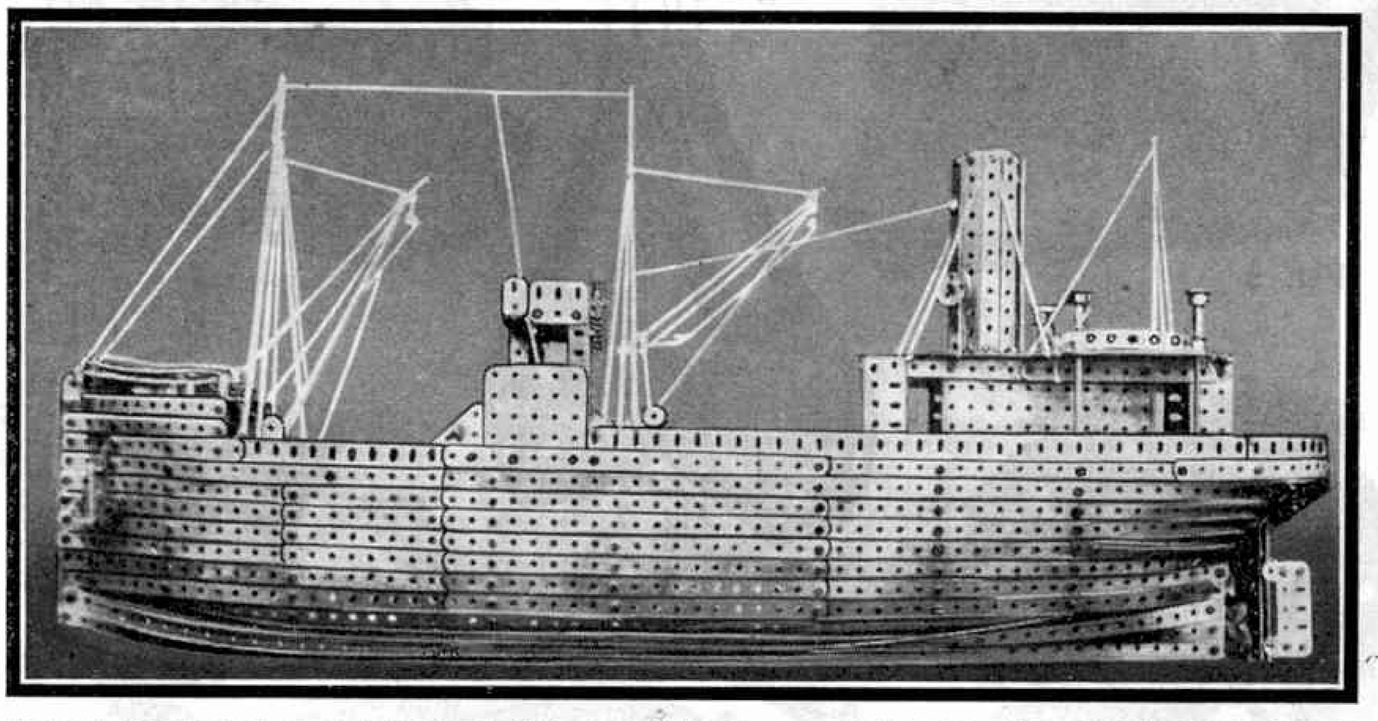
Details of Many of the Outstanding Models in the Home Sections

LAST month the first details of the results of the Grand £100 Model-building Competition were published. Owing to the large number of prizes awarded, the article was devoted entirely to a list of the names of model-builders who had secured awards in the three Home Sections, and any details of the models themselves could not be published.

Now that space permits, however, I wish to take the opportunity of congratulating all those model-builders who obtained prizes on the excellency and ingenuity of their work, and to offer a word of encouragement to those who were not so fortunate as to receive an award. A large number of entries, although not quite up to prize-winning standard, showed great promise, and if the builders will only persevere there is no reason why the next contest should not see their names among the list of prize-winners.

The results have provided a wonderful proof of the overwhelming popularity of Meccano model-building, and also to the enthusiasm and ingenuity of the model-builders themselves.

I am looking forward to being able to publish the results of the Overseas Section (this Section closed on the 30th of last month), and if the quality of the models is anything like as high as that shown in the Home entries, some very remarkable models will be forthcoming.



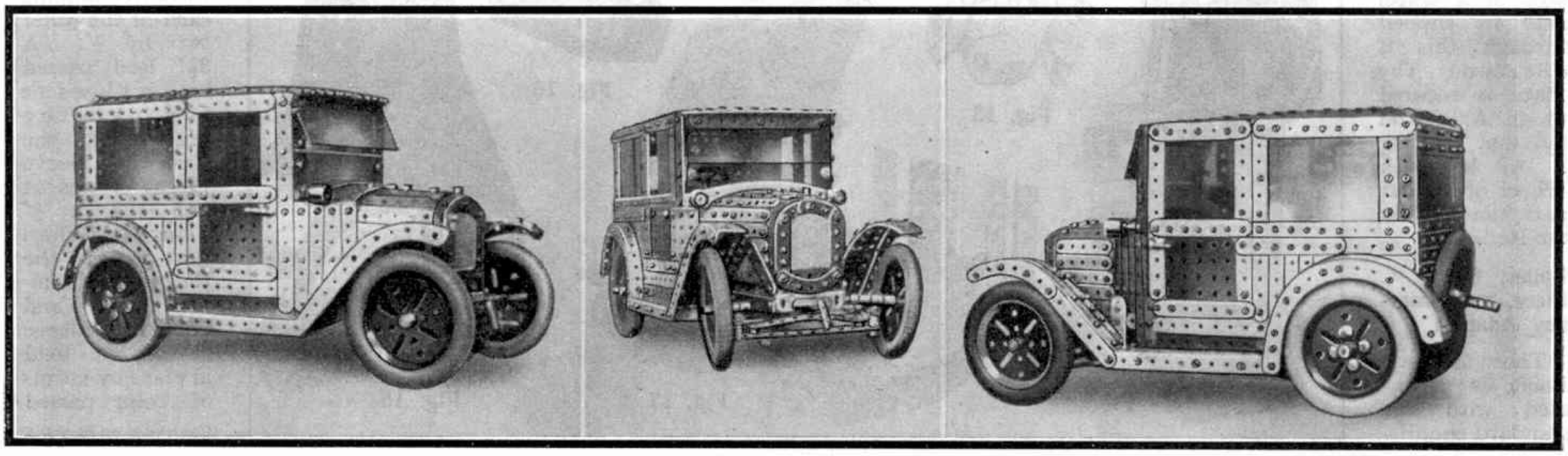
(Above) Coasting Steamer built by E. Roberts. This clever model tied for Second Prize in Section B.
(Below) A novelty in model car construction. "Austin Seven" Motor built by A. M. Johnston (First Prize tie, Section B)

Reverting to the Home Sections once more, several models of equal merit were received in Section A, and it was consequently impossible to award the First, Second, or Third Prizes to any single competitor. The prizes were therefore divided, the First Prize being awarded jointly to W. D. Schofield, R. S. Miller, A. T. Locke, and Eric Whalley. Schofield's model consists of a large Dragline Excavator—a fact that will be already known to many readers, as an excellent illustration of this model appeared in last month's article. Its realistic appearance cannot have failed to create something of a stir in model-building circles!

The model is a reproduction of a Ruston Oil-Electric Dragline, manufactured by Ruston & Hornsby Ltd., for canal excavation purposes in India. In many respects the Dragline is the most perfect Meccano model of an excavating machine that has yet been brought to my notice, and while there are one or two points where slight improvements might be made, the construction is a triumph of ingenuity and model-building skill. When compared with a photograph of the actual Ruston machine, the likeness of the model to the original is amazing. It is interesting to note that this model was recently exhibited at an Arts and Crafts Exhibition in Grantham, organised by Ruston & Hornsby Ltd., and received favourable comment from all who saw it.

Two other model-building masterpieces in a totally different field were submitted by R. S. Miller and A. T. Locke. The entries of both these competitors were model locomotives; Locke's model of the G.W. engine "*King George V*" being illustrated last month, while the "*Flying Scotsman*" built by R. S. Miller is shown on the opposite page. Many readers will know that R. S. Miller has distinguished himself on several previous occasions in contests for the construction of "super" models of locomotives, his reproduction of the famous engine "*Locomotion No. 1*" (illustrated in the 1929 Book of New Models) being particularly outstanding.

His latest work, however, is certainly the finest that he has yet produced, and while not altogether perfect it is indeed a remarkable achievement. The dimensions of the various units of the engine and its corridor tender have been accurately scaled, and construction has been so carefully carried out that quite a large amount of the grace, power, and speed that the appearance of the original engine suggests, is reflected in the model. I cannot help viewing with disfavour, however, the addition of a "non-Meccano" fire-box door, chimney, and steam dome. These parts certainly look quite realistic, but their use was by no means necessary as standard Meccano accessories could have been employed in each case with quite good results. In place of the chimney, for instance, two 1¼" Flanged Wheels bolted together could have been employed, while an effective steam dome could be improvised from a Contrate Wheel. A neat finish to the end of the boiler could be obtained by using a Hub Disc "filled in" with a number of Triangular Plates.



While the locomotive itself is a very fine piece of work, the tender is no less interesting. It has, of course, been modelled on the recently introduced corridor type, and I should imagine that in building it no little time and patience were expended before the builder achieved the neat result seen in the illustration. Readers will note the ingenious use of Channel Segments as "wheel splashers" on the engine, and the springs fitted to the tender.

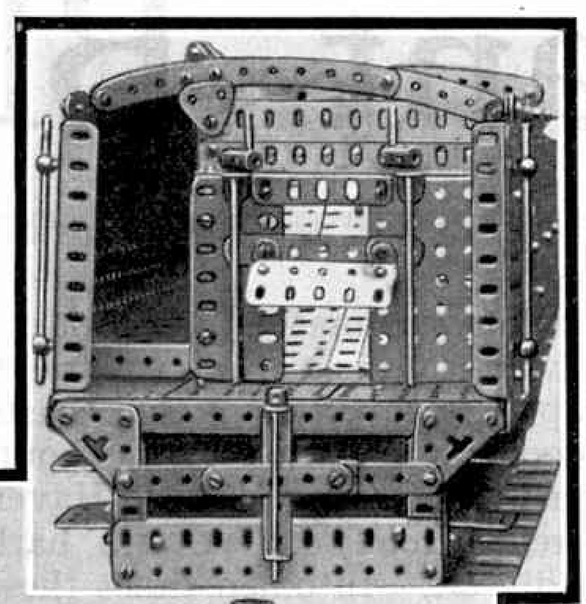
The "*King George V*" locomotive built by A. T. Locke, showed an entirely different style of construction from that employed in the engine just mentioned. While not including anything like as much detail as R. S. Miller's model, the engine nevertheless has been built on sound model-building lines, and incorporates constructional features that might well be copied by any model-builder. Locke has only recently entered the locomotive model-building field, and his early success is therefore all the more creditable.

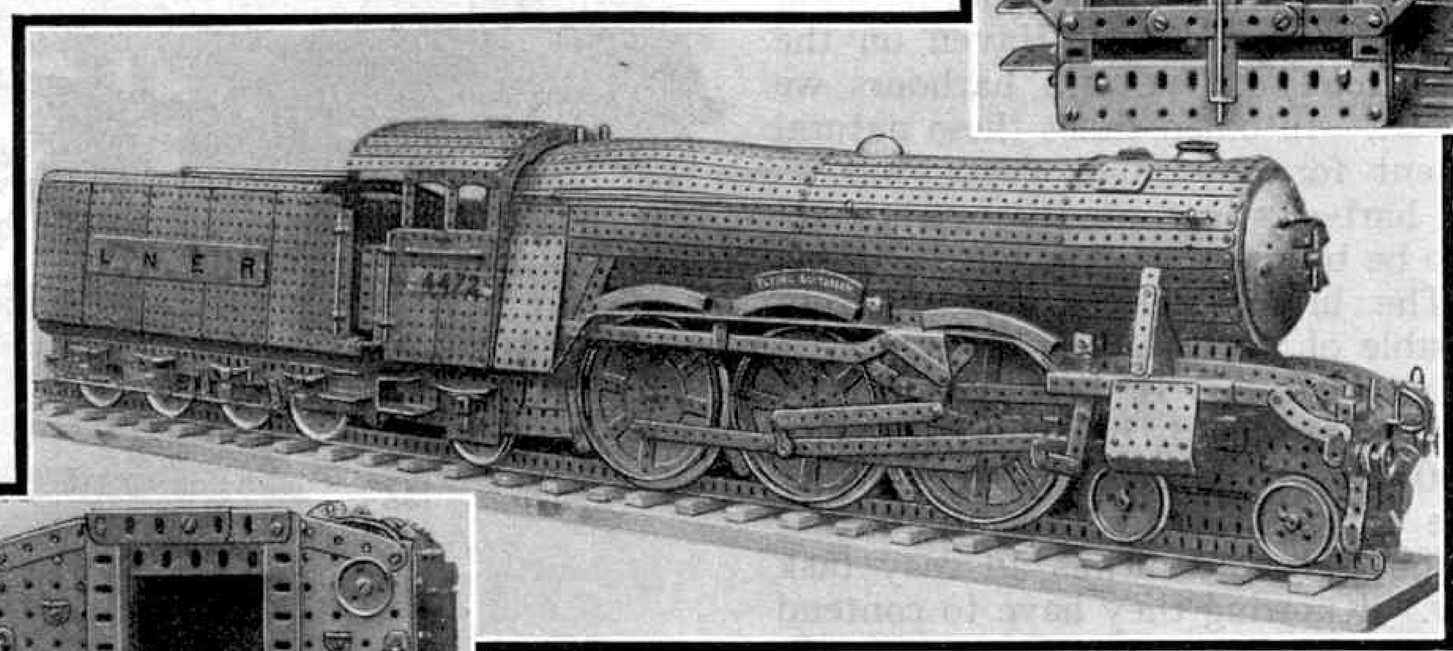
Entries of equal merit were also submitted in Section B, and the First Prize was therefore awarded jointly between R. Kirkham and A. M. Johnston. The model steam wagon and trailer comprising Kirkham's entry was illustrated last month, and readers should turn to the previous article and take a glance at this excellent model which, although built to a comparatively small scale, includes a wealth of detail.

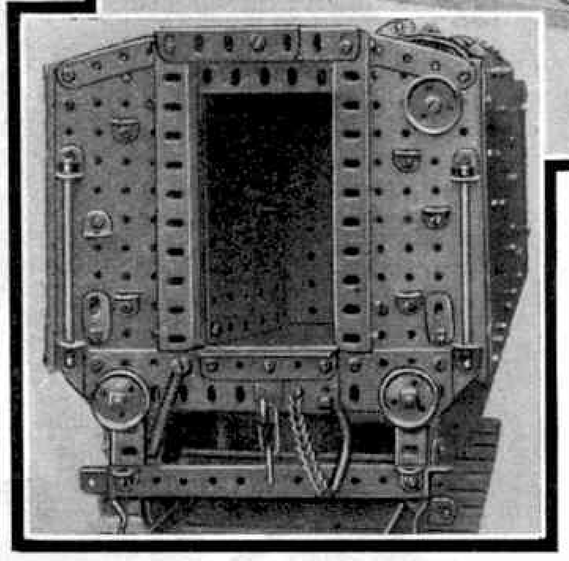
The model evidently represents a vehicle of up-to-date type, being of the six wheeled variety. The addition of a flywheel, chimney, and steering mechanism will be noted, while all will agree that the construction of the bodywork, both of the wagon and the trailer, is above reproach.

The model that tied with the Steam Wagon was also a road vehicle, but of a vastly different type, as the illustrations on the opposite page show! Its builder, A. M. Johnston, certainly hit upon a novel subject when he decided to build a model of a "baby" car. Some excellent models of the larger types of car have of course been submitted in the model-building contests from time to time, and indeed, many good examples were included amongst the entries for this competition; but small cars have not as yet received the attention of the general model-builder. No doubt this excellent example will stimulate interest in this type of construction.

I was particularly struck by the appearance of the model of the "*Rocket*" locomotive built by Albert Holmes, and illustrated on this page. The model provides a wonderful contrast in design to R. S. Miller's "*Flying Scotsman*" engine previously mentioned. The contrast could hardly apply to the constructional work, however, for readers will agree that there is little to choose between the two in regard to the manner in which they have been built up. In a model of this type, external appearance



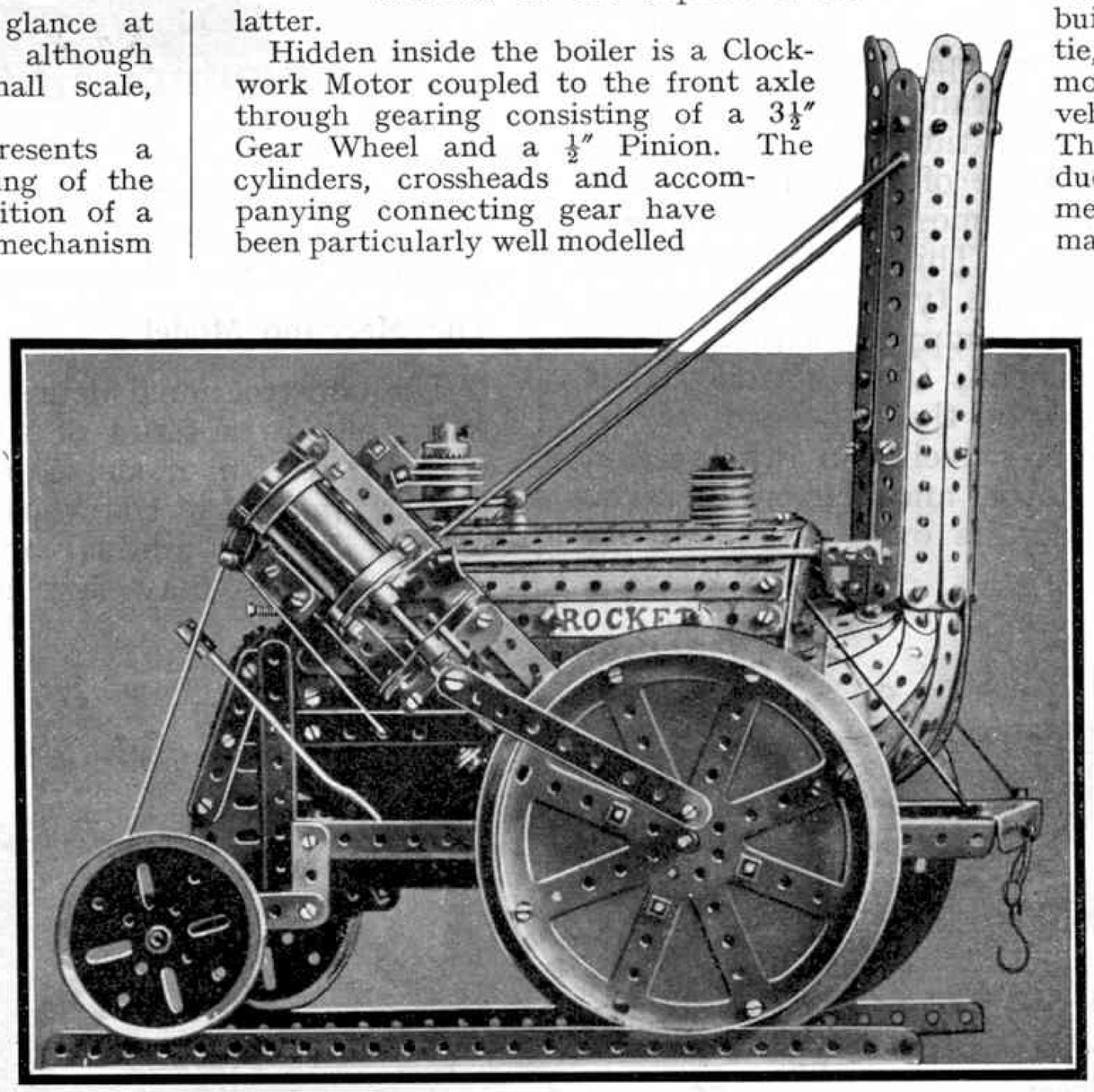




A remarkable model of the "Flying Scotsman," built by R. S. Miller. (First Prize, tie, Section A). The two views of the corridor tender, when compared with the illustrations that appeared in the July, 1928 issue of the "M.M.," will show how accurately it has been constructed

is almost as important as the mechanical features, and I am pleased to say that the former has been attained naturally, and not at the expense of the latter.

Hidden inside the boiler is a Clockwork Motor coupled to the front axle through gearing consisting of a 3½" Gear Wheel and a ½" Pinion. The cylinders, crossheads and accompanying connecting gear have been particularly well modelled



A model of Stephenson's "Rocket," constructed by Albert Holmes (Second Prize, tie, Section B). The effect of a century of progress on the design of the locomotive will be noted by comparing this model with the one shown in the upper illustration

to correct proportions. I was somewhat puzzled, however, to discover what Meccano parts composed the cylinders, as they are obviously of greater diameter than the Sleeve Piece (Part No. 163). The cylinders consist actually of Ship's Funnels, the bottom ends of which have been removed! The effect is certainly good, but it is poor model-building practice to mutilate the standard parts in this way. Sleeve Pieces and ¾" Flanged Wheels could have been used here with an equally realistic result. An improvement in running would also be effected if built-up flanged wheels consisting of Face Plates and Hub Discs were substituted for the 3" Pulleys that are at present used as the rear wheels. Meccano Pulleys should never be employed where the machine has to run on rails, on account of the tendency of the groove in the Pulley to "bind."

A constructional feature that merits the highest praise is the manner in which the base of the chimney is fitted to the boiler end. The arranging and bending of the Strips that compose this portion of the model must have entailed considerable experiment and patience before the neat result seen in the illustration was achieved.

Quite the most novel entry in the Home Section was the model Mono-cycle built by C. P. Plantin (second prize, tie, Section A). This remarkable model represents a motor-propelled vehicle travelling on one wheel! The design of the model is largely due to its builder, although experiments with a somewhat similar machine have recently been carried out in America, and the model is not therefore so very "far-fetched" as might at first appear! The main feature of Plantin's model consists of a ring wheel, built up from a number of Channel Segments. To each side of the ring several spokes are secured, the spokes carrying at their centres Face Plates, which form journals for a centre Axle Rod.

The motive power consists of a Meccano Electric Motor and Accumulator, mounted on a separate framework or "cradle." This framework is suspended from the central axle, the motor being coupled to a Gear Wheel on the axle by means of gearing. The action of the model is as follows. When the Motor is started, the gears in the swinging framework mesh with the gear on the centre shaft and cause the ring wheel to rotate, thus driving the machine along.

Meccano Super Model No. 4

Giant Block-setting Crane

ON every coast line, no matter which one you take, you will always find a few natural harbours. This rule applies equally to the coasts of the British Isles. Good examples are given by Southampton Water on the south coast and Milford Haven on the west, but if we relied solely on natural harbours we should be very badly off. In olden times these natural harbours were sufficient for our small fleets, but as times changed more harbours became necessary. So artificial means had to be brought into use where nature would not oblige. The breakwaters which are constructed must be capable of withstanding an enormous pressure caused by the waves. It is not generally realised what force waves can exert, but when a breakwater weighing 3,300 tons has been moved bodily by the action of the waves we can understand that breakwater construction is by no means an easy task to complete efficiently. Knowing they have to contend with such a great force, engineers have consequently to design their breakwaters on a large scale. Some of the most well-known artificial harbours are those at Portland and Dover, while every boy has heard of the famous Mole at Zeebrugge. We would naturally expect that such huge structures would demand huge machinery to construct them, and this is actually the case. Cranes capable of lifting blocks of concrete and granite weighing anything up to about 50 tons have to be made, and some of the largest cranes in existence are those used in harbour construction.

This magnificent model is a reproduction of one of the huge Titan block-setting cranes that have been illustrated and described from time to time in the "*M.M.*" and which, as we have often pointed out in the "*M.M.*," form one of the most suitable subjects for reproduction in Meccano. This particular crane is one of the finest examples of its type, and has several distinct movements. It is equipped with Fidler's block-setting gear, which depends from a trolley that is drawn along a pair of rails on the upper side of the boom. The boom itself can be swivelled in any direction by means of an Electric Motor, and the entire crane is capable of travelling under its own power on four separately-propelled bogies—every action, in fact, which can be carried out by the actual crane, is reproduced in the Meccano model.

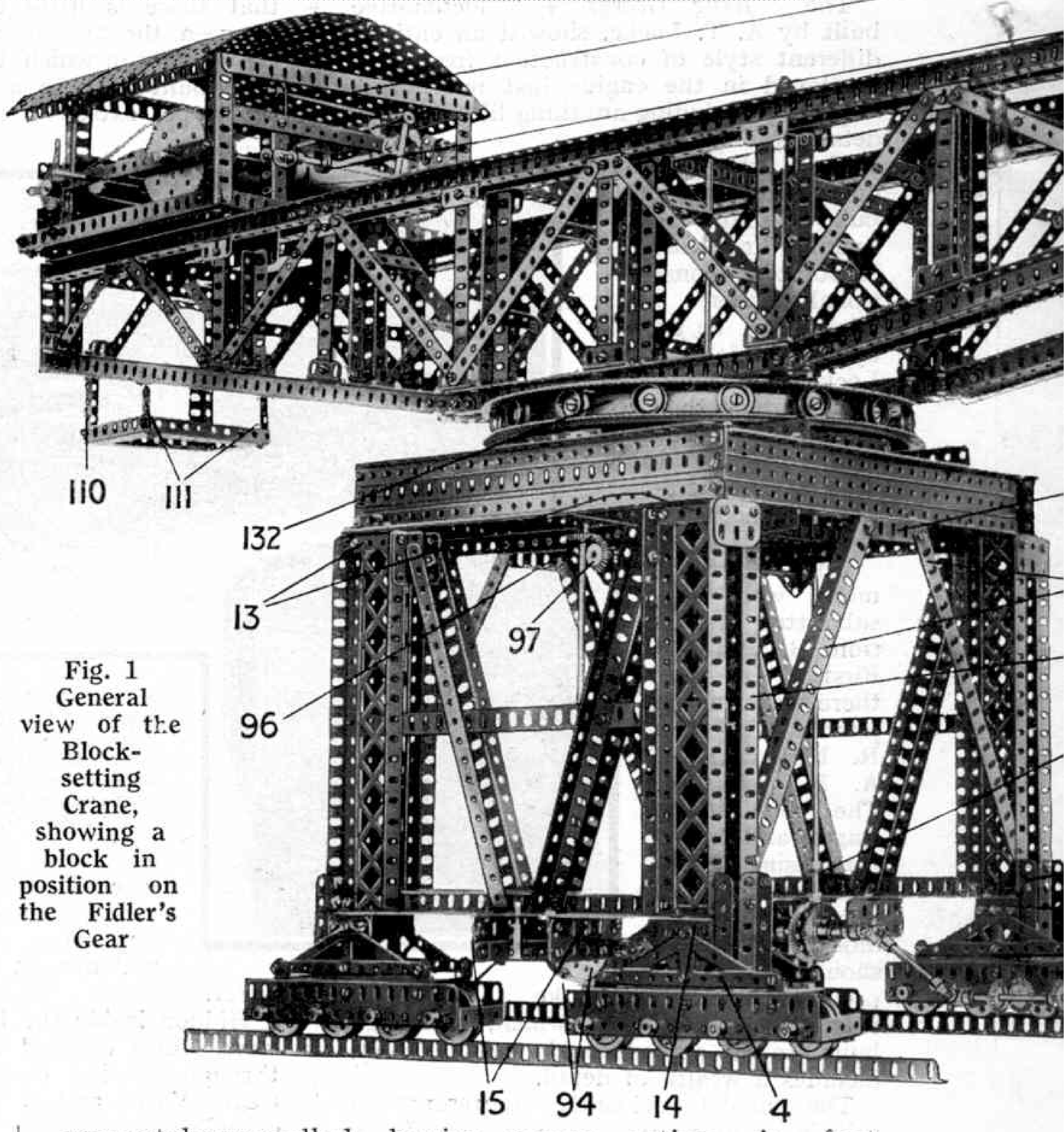


Fig. 1 General view of the Block-setting Crane, showing a block in position on the Fidler's Gear

The Meccano Model

The constructional details of the model will be dealt with fully in a series of special articles of which this is the first. The model is designed on the unit principle, so that, instead of the whole structure being laboriously erected by the gradual addition of single parts, the main portions may first be built as separate units. Each unit is as simple to construct as a small

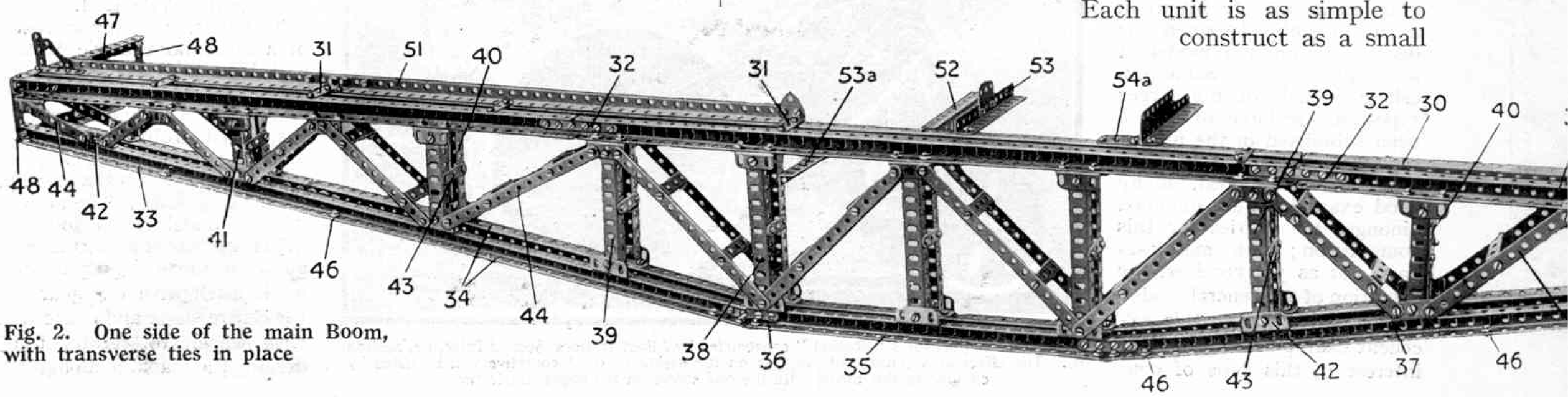


Fig. 2. One side of the main Boom, with transverse ties in place

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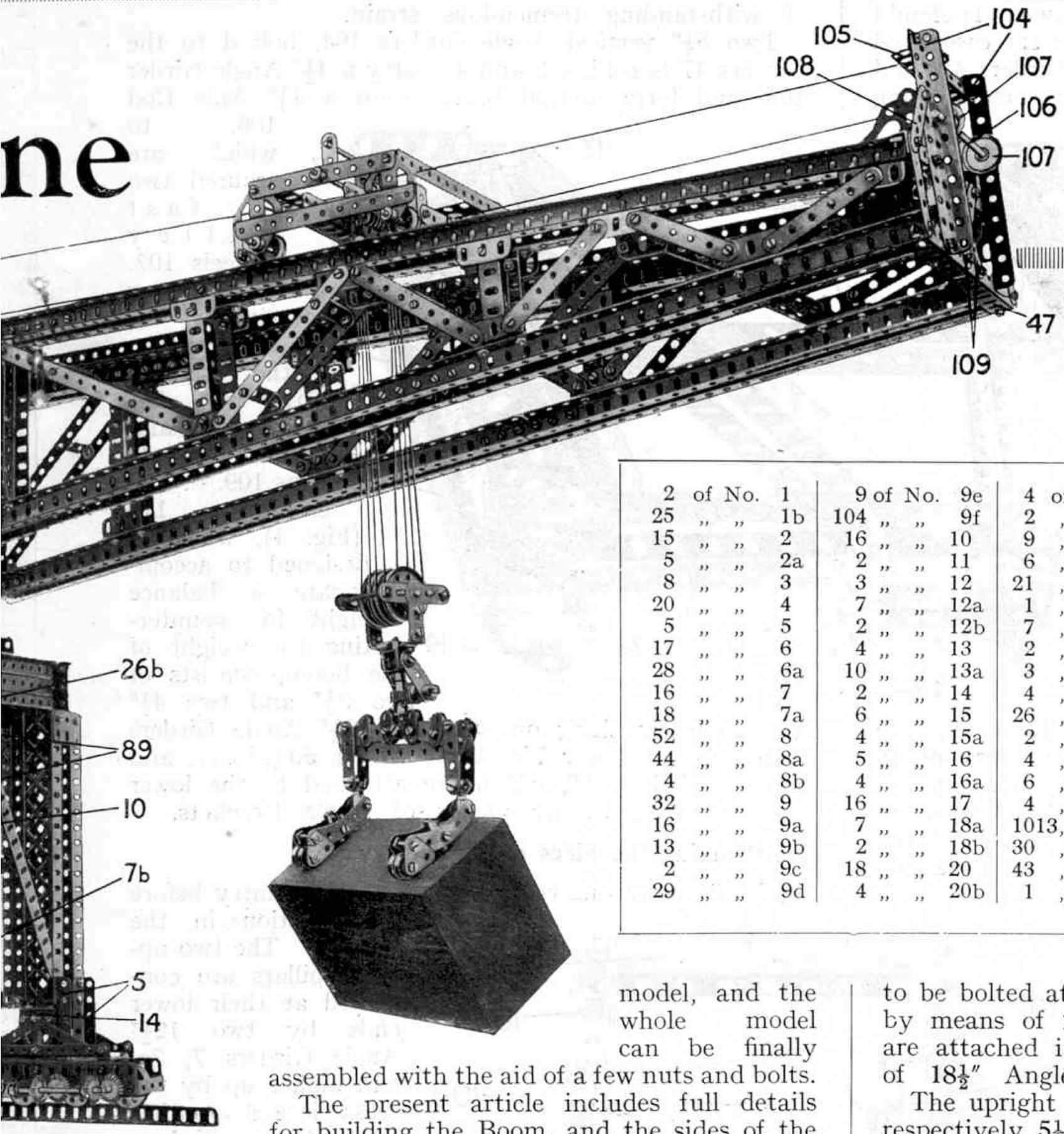


The Largest Meccano Model

Parts required:

2	of No.	1	9	of No.	9e	4	of No.	21	4	of No.	103f
25	„ „	1b	104	„ „	9f	2	„ „	22	9	„ „	103h
15	„ „	2	16	„ „	10	9	„ „	22a	8	„ „	103k
5	„ „	2a	2	„ „	11	6	„ „	23	2	„ „	106
8	„ „	3	3	„ „	12	21	„ „	24	6	„ „	111
20	„ „	4	7	„ „	12a	1	„ „	25	7	„ „	111c
5	„ „	5	2	„ „	12b	7	„ „	26	8	„ „	113
17	„ „	6	4	„ „	13	2	„ „	26a	5	„ „	114
28	„ „	6a	10	„ „	13a	3	„ „	27	6	„ „	115
16	„ „	7	2	„ „	14	4	„ „	27a	8	„ „	126
18	„ „	7a	6	„ „	15	26	„ „	30	12	„ „	126a
52	„ „	8	4	„ „	15a	2	„ „	30a	4	„ „	127
44	„ „	8a	5	„ „	16	4	„ „	30c	3	„ „	133
4	„ „	8b	4	„ „	16a	6	„ „	31	6	„ „	136
32	„ „	9	16	„ „	17	4	„ „	32	2	„ „	139
16	„ „	9a	7	„ „	18a	1013	„ „	37	2	„ „	139a
13	„ „	9b	2	„ „	18b	30	„ „	37a	8	„ „	140
2	„ „	9c	18	„ „	20	43	„ „	38	3	„ „	144
29	„ „	9d	4	„ „	20b	1	„ „	45	3	„ „	147b
									1	„ „	160
									1	„ „	165
									1	„ „	166
									1	„ „	167
									1ft.	„ „	94
									1	„ „	95b
									3	„ „	96
									8	„ „	99a
									8	„ „	103a
									6	„ „	103b
									1	„ „	103c
									1	„ „	103d

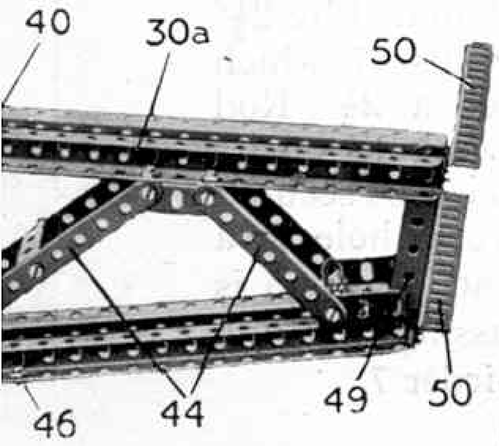
model, and the whole model can be finally assembled with the aid of a few nuts and bolts.

The present article includes full details for building the Boom, and the sides of the Gantry, etc. In the June "*M.M.*" we shall describe the top of the Gantry and the Roller Race, etc., together with instructions for assembling the various parts of the Gantry, while details of the Gear Box and all particulars necessary to complete the model will appear in later issues.

Structural Details of the Boom

Fig. 2 is a view of one side of the boom: the other side, being exactly similar, has been removed for the sake of clearness. Each side should be built separately in accordance with the instructions given below, and the whole then assembled into the complete unit.

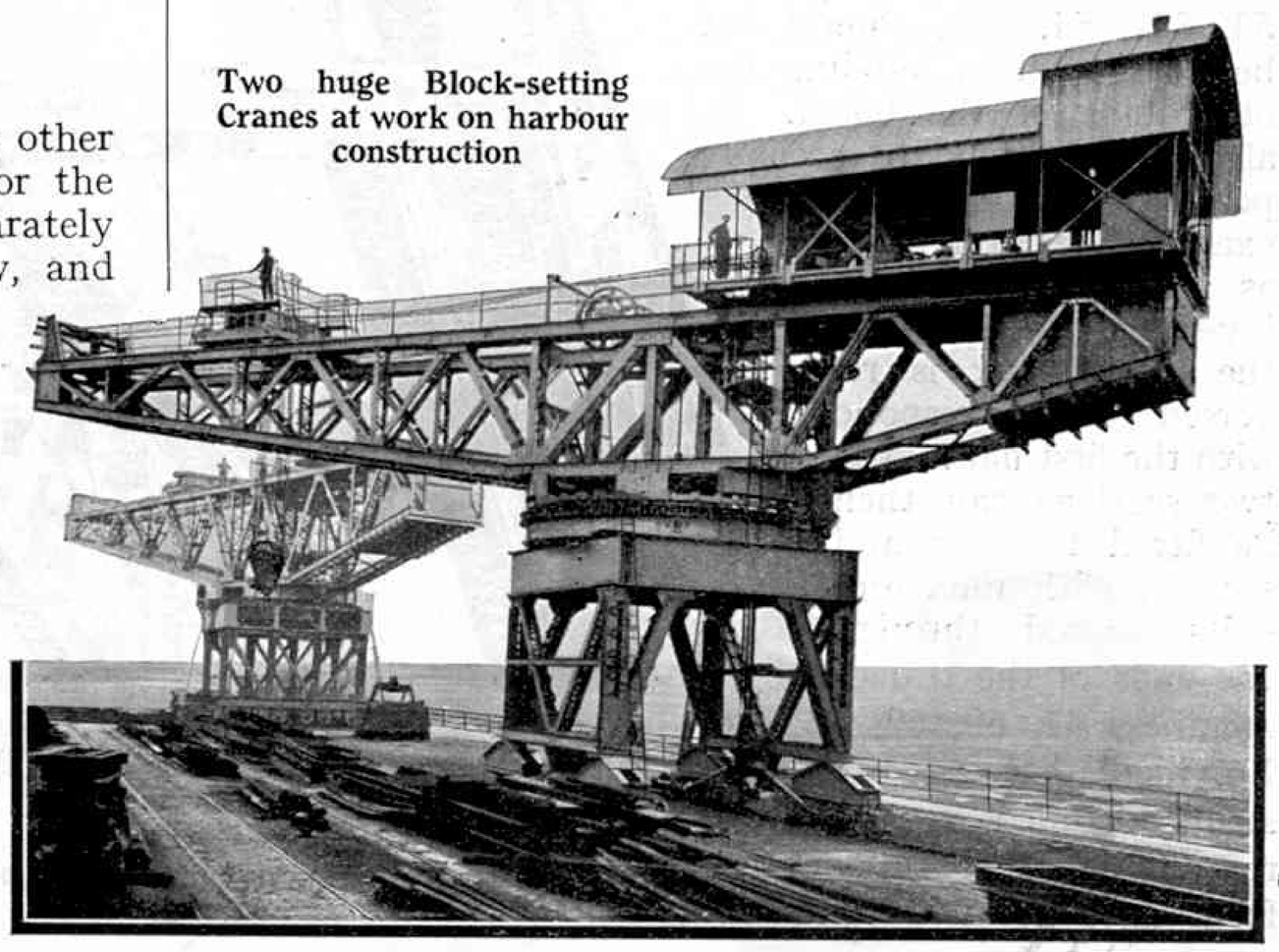
Along the upper edge extend a pair of U-section channel girders 30 and 30a, each composed of four 24½″ and two 12½″ Angle Girders bolted together in pairs and joined end to end by the 3″ Strips 32. Six 1½″ Strips 31 hold the channel girders 30, 30a side by side about ½″ apart.



The girders forming the lower edge are similarly constructed, the forward end consisting of 12½″ channel girders 33 and 18½″ channel girders 34. The slotted holes of the Girders allow them to be bolted at an angle to the 12½″ centre Girders 35 by means of 2″ Strips 36. The Channel Girders 37 are attached in the same manner and are composed of 18½″ Angle Girders.

The upright Angle Girders 38, 39, 40, 41, which are respectively 5½″, 4½″, 3½″ and 2½″ long, are bolted to the upper Girders 30, 30a, and to the lower Girders 35, 34, 33 and 37 by means of 1½″ Angle Girders 42, and are connected by 1½″ Strips 43, while the oblique struts 44, the different lengths of which are clearly seen in Fig. 2, are bolted to the Girders 42 and joined

Two huge Block-setting Cranes at work on harbour construction



by $1\frac{1}{2}$" by $\frac{1}{2}$" Double Angle Strips as shown. It should be noted that the Strips 44 are not in every case fixed to the same point on the short Angle Girders 42, and that, although there is no upright Girder (corresponding to 38, 39, 40, 41) near the extreme end of the boom, the short Girder 42 is included in order that the Strips 44 may be attached to it. The lower channel girders are joined in the same way as the upper girders 30, 30a by $1\frac{1}{2}$" Strips at the points 46.

On the forward end of the boom are bolted two $7\frac{1}{2}$" Angle Girders 47 connected by $2\frac{1}{2}$" Strips 48, while the opposite end of the boom bears two $3\frac{1}{2}$" Angle Girders 49, to which are attached the $7\frac{1}{2}$" Angle Girders 50.

The rail 51 is bolted under the Strips 31 to the Girder 30, its end hole coinciding with the third hole of the girder, and is provided with stops consisting of a Flanged Bracket and a 1" Triangular Plate.

The end of a $5\frac{1}{2}$" Angle Girder 52 is bolted in an inverted position to the inside upper edge of the Girder 30: two similar girders are attached to the upper edge of the Girder 30, and carry respectively a $1\frac{1}{2}$" and a $3\frac{1}{2}$" Flat Girder. Another $1\frac{1}{2}$" Flat Girder 54a is bolted lengthwise by its slotted holes to the Channel Girder 30. A $5\frac{1}{2}$" Angle Girder 53a is bolted as shown to one of the vertical Angle Girders 38.

The parts 47, 48, 50, 52, 53, 53a, 54, 54a, should not be duplicated in building the other side of the boom. In all other respects the second portion is constructed in exactly the same manner as the first, but in an inverse direction, i.e., the whole unit is reversed to correspond with the first half. The two sections can then be fitted together and secured with nuts and bolts passed through the ends of the transverse members 47, 50, 52, 53, etc. Provided that all the ties and struts included in the illustrations are reproduced the complete boom will form an extremely rigid unit, capable of withstanding tremendous strain.

Two $5\frac{1}{2}$" vertical Angle Girders 104, bolted to the Girders 47 (see Figs. 2 and 4), carry a $4\frac{1}{2}$" Angle Girder 105, and form journal bearings for a $4\frac{1}{2}$" Axle Rod 106, to which are secured two 1" fast Pulley Wheels 107. Further rigidity is imparted to the structure by two $2\frac{1}{2}$" Strips 108 and the crossed $\frac{1}{2}$" Strips 109. The "cradle" 110 (Fig. 1), which is designed to accommodate a balance weight for counteracting the weight of the boom, consists of two $3\frac{1}{2}$" and two $4\frac{1}{2}$" Angle Girders slung on a pair of $2\frac{1}{2}$" Angle Girders bolted to the lower $7\frac{1}{2}$" Angle Girder 50 (Fig. 2), and two $1\frac{1}{2}$" Strips 111, which are attached to the lower channel girder 37 by means of Angle Brackets.

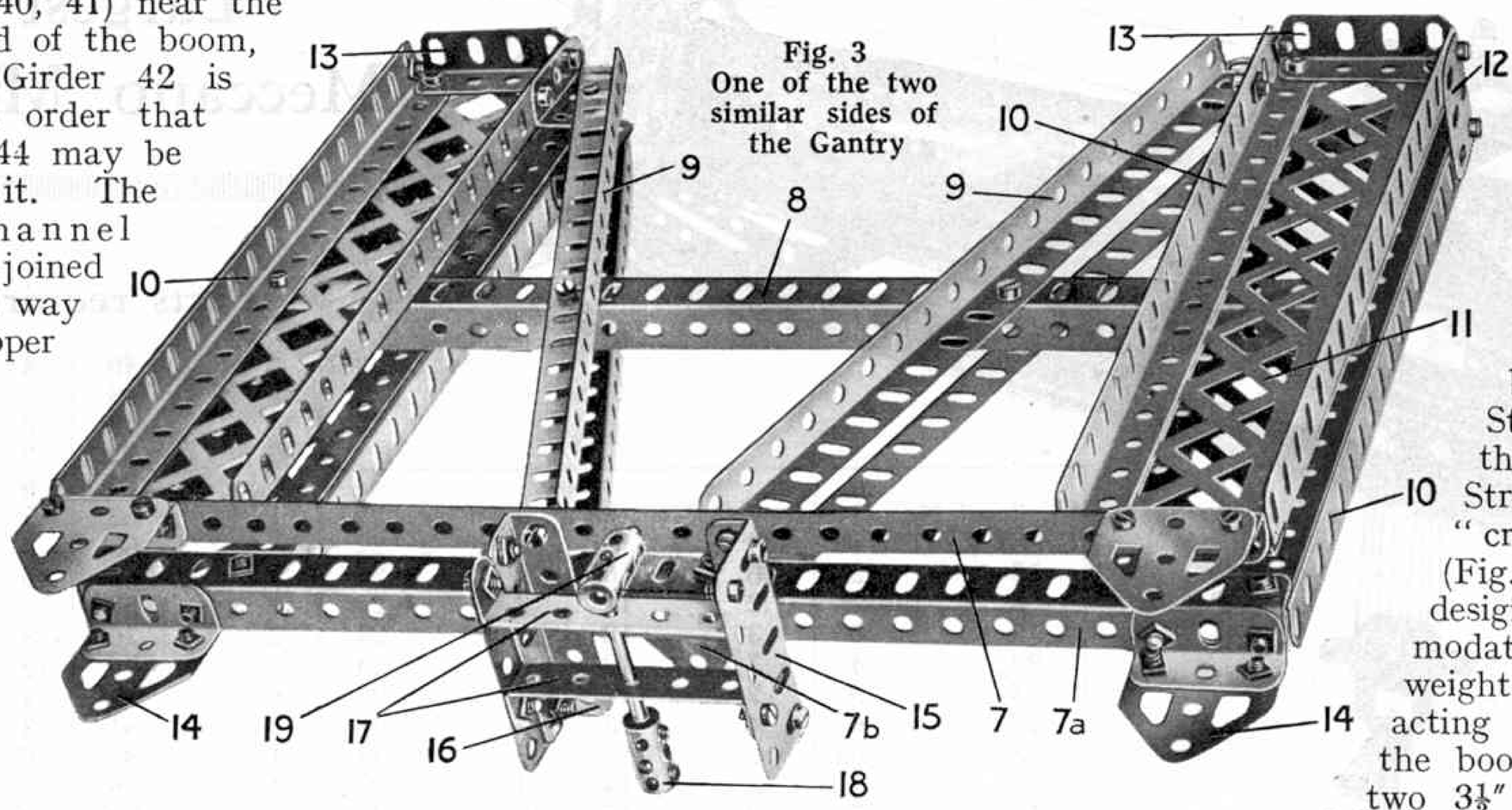


Fig. 3
One of the two similar sides of the Gantry

Constructing the Sides of the Gantry

Fig. 3 shows one complete side of the gantry before incorporation in the model. The two upright pillars are connected at their lower ends by two $12\frac{1}{2}$" Angle Girders 7, 7a, and higher up by the cross-piece 8 (another $12\frac{1}{2}$" Angle Girder), and are further supported by the struts 9 (four $9\frac{1}{2}$" Angle Girders). Each of the pillars consists essentially of four $9\frac{1}{2}$" Angle Girders 10 bolted at their lower ends to the Girders 7, 7a, and joined by Braced Girders 11 and Flat Girders 12.

The Girders 7, 7a carry four Flat Trunnions 14 and a framework consisting of two $2\frac{1}{2}$" Flat Girders 15 bolted to the $2\frac{1}{2}$" Angle Girders 16 and joined by $2\frac{1}{2}$" Double Angle Strips 17, which form bearings for a $2\frac{1}{2}$" Rod carrying the Coupling 18 on its inner end. This Rod is also secured in the lowest transverse hole of a Coupling 19, in the end of which is gripped a 1" Rod passing through the centre hole of the Girder 7.

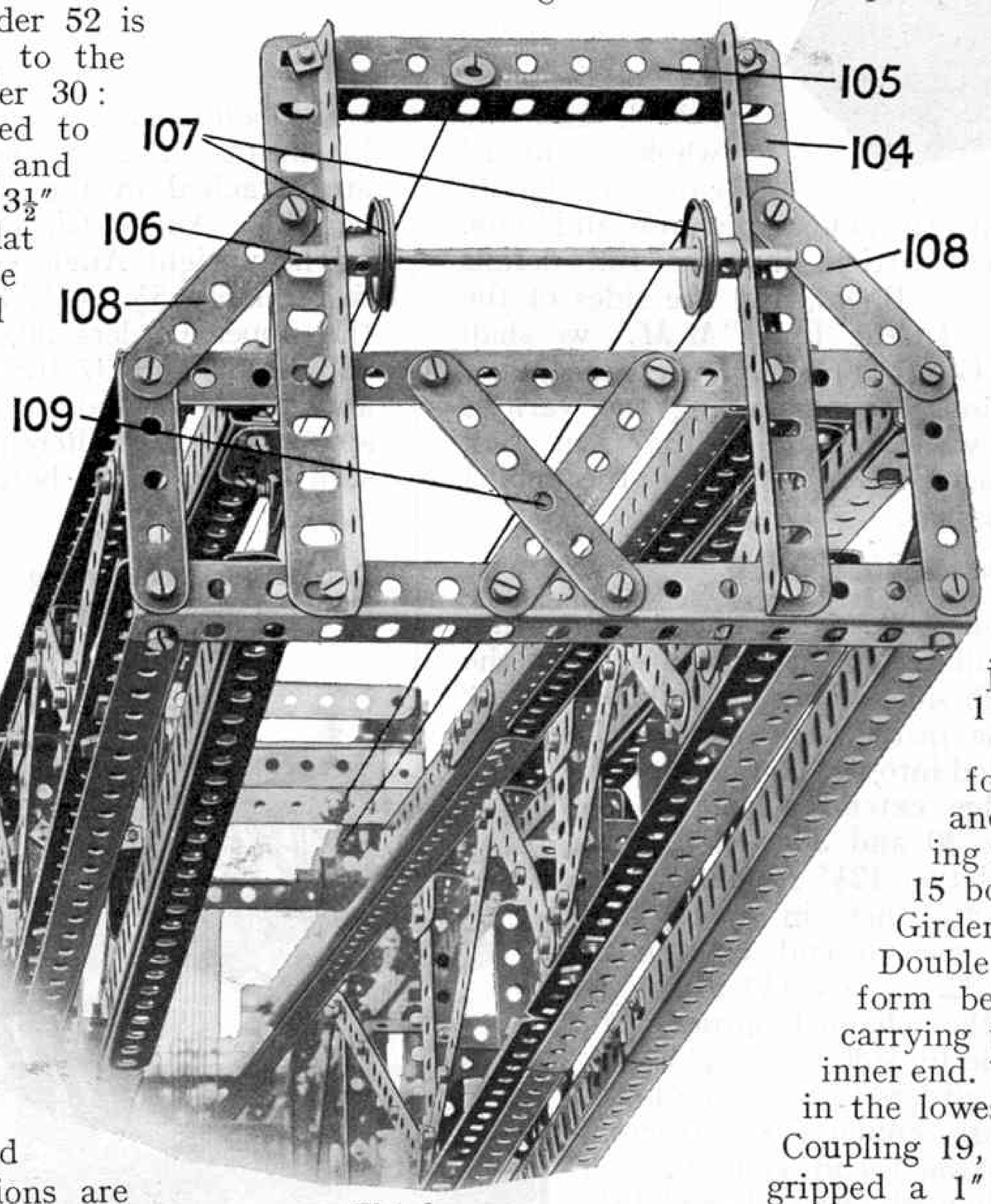
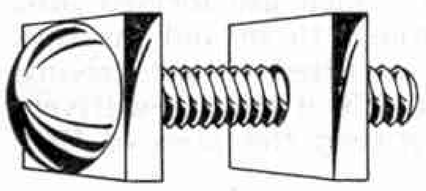


Fig. 4
End perspective view of Boom

(To be Continued)

In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

"BUTTON" HEAD BOLT.—In building rotary switches of Meccano in which an arm has to pass over a number of separate contacts (as for example in the Resistance Controller described in last month's "Suggestion Section") it is often difficult to obtain smooth working of the switch arm as it is liable to catch on the square heads of the 6 B.A. Bolts that form the contacts. In order to overcome this difficulty you suggest that a 6 B.A. Bolt similar to the illustration should be introduced. The upper surface of the head would be domed so that smooth make and break could be obtained, while the sides of the head would be cut to the same size as a standard Meccano nut, thus enabling the bolt to be manipulated by means of a Spanner. This idea appears to be quite sound and we will give it careful attention. (*Reply to R. Parr, South Ealing, London, W.5*).



NEW GEAR WHEELS.—A gear wheel having teeth cut around only part of its periphery would form quite a useful addition to the system. We would, however, remind you that a Rack Segment (part No. 129) can often be used in place of your suggested wheel where it is required to impart intermittent motion to a shaft. (*Reply to R. Walsby, Henstridge*).

DOUBLE ARM CRANK.—We have inspected your sketch of a crank having two arms, but we fail to see in what way it differs from the Double Arm Crank (part No. 62b) that is already included in the system. (*Reply to H. I. G. Gill, Redruth*).

VOLTMETER. — This suggestion has been replied to recently in these pages, but as we consider a miniature voltmeter would form a very interesting addition we will certainly give your ideas further attention. (*Reply to J. E. Mort, J. B. C. James and P. Phizackerley, Llandrindod Wells*).

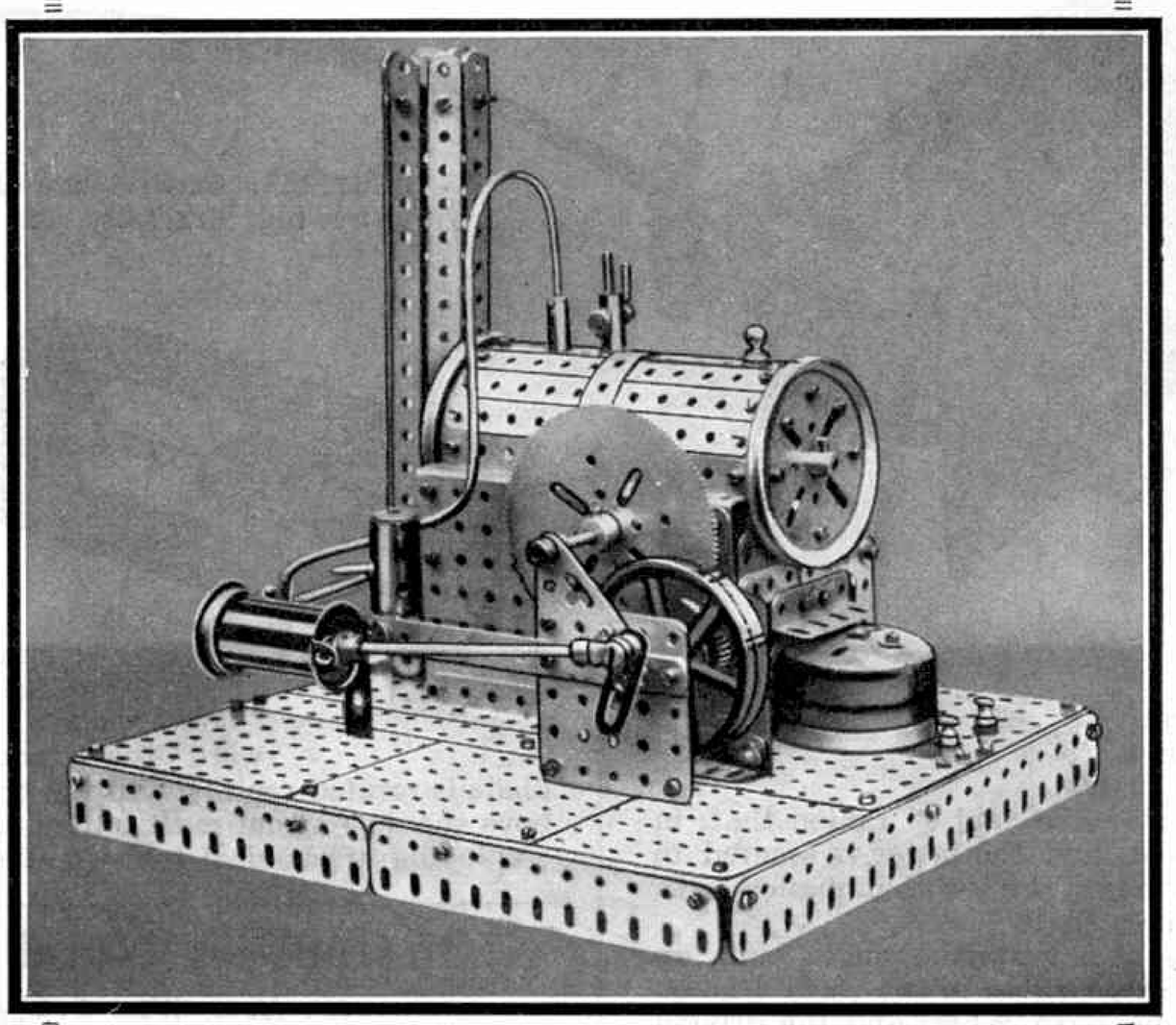
RUBBER TYRES.—Rubber tyres moulded with a number of projections or "spikes" around their periphery would certainly provide an excellent grip for the road wheels of a Meccano model tractor, etc. While we are aware that tyres of this pattern would form a satisfactory substitute for caterpillar track, we feel sure that model builders would prefer to build up caterpillar track as far as possible from existing parts. We are therefore carrying out experiments in order to determine the most suitable means of doing this. Readers suggestions will be welcomed. (*Reply to G. Dixon, Rugby*).

IMPROVED SHUTTLE.—Your proposed improvements to the Shuttle appears to be quite sound. You mention that the circular hole through which the cotton passes from the spool, should be elongated so that the friction between the cotton and the edge of the Shuttle would be reduced when the Shuttle is at either extremity of the "slay." We will give this idea attention. (*Reply to S. Morovay, Sutton Coldfield*).

5½" × 1½" PLATE.—Very few cases could be found where this size of plate would be particularly useful. Where specially required, it is quite a simple matter to devise a plate of this size from two 5½" Flat Girders bolted together by their slotted holes. (*Reply to E. R. Veater, Merton, S.W.19*).

CONICAL DISC.—We were interested in your suggestion for a further use for a conical disc. You suggest that two of these discs should be employed in the construction of a variable-diameter pulley, for use in a variable belt transmission gear. The discs would be mounted so that the points of their cones converged, and some mechanism would be employed so that the discs might be moved near together or away from each other. This is a very interesting application of the suggested part, and we will certainly bring it into consideration when deciding as to whether a conical disc should be introduced. (*Reply to J. Neijts, s'Bosch, Holland*).

A "Steam-Electric" Power Plant!



This interesting model, built by E. H. Bradshaw of Sheffield, has all the appearance of a toy steam plant, but hidden inside the fire-box is a Meccano 4-volt Motor, which drives the "engine" at a good speed. The model secured one of the principal awards in Section A of the "September" Model-building Contest, the results of which appeared last month

POLE PIECES.—Your suggested pole piece, consisting of a strip of soft iron bent so that it would pass round the armature, could certainly be employed in the construction of an electric motor, but we do not think that results would be very satisfactory when such a small amount of iron was present near the armature. By cutting a slot in one end of your proposed part it would be possible to pass a number of standard Meccano Strips through it, and so build up an electro magnet for the field. Results would, however, hardly justify the introduction of this special accessory. (*Reply to K. Lawson, Hull*).

SOLID TYRE.—There would be no point in introducing rubber motor tyres of the type often fitted to commercial lorries, etc., as the existing 2" and 3" Dunlop Tyres can be included effectively in all styles of motor vehicles. When building models of cycles and motor cycles, however, the 3" Rubber Ring (part No. 142) will come in very handy. (*Reply to A. King, Bentley*).

6" DUNLOP TYRE.—It would be very difficult to find uses for a rubber tyre manufactured to fit the 6" Pulley Wheel and we do not therefore feel justified in giving your idea further consideration. (*Reply to S. M. Manol, Ipswich*).

EYE-PIECE.—We have been rather surprised to receive several requests that the old-style Eye-Piece should be re-instated in the system. The improved pattern fitted with boss is vastly superior in every respect to the old eye-piece and we cannot find any model where the new Eye-Piece will not produce an improvement. (*Reply to L. Fairs, Keswick and R. L. Jones, Bath*).

LUBRICATORS.—We have noted your suggestion that miniature "Stauffer" lubricators should be introduced. In actual practice these consist of metal tubes filled with solidified grease, and set obliquely to the axles that are to be lubricated—the grease being forced on to the axle by means of screw pressure. Your suggestion offers possibilities, but before considering introducing these articles it will be necessary to make sure that a lubricator of this type cannot be devised from standard parts. We will be pleased to hear from any reader who has improvised one of these lubricators. At the same time, it should be borne in mind that a very efficient lubricator of the "syphon" type was described under Suggestion No. 143 (see December "Suggestions Section"). (*Reply to E. Newton, Hull*).

NEW CRANK.—A double arm crank having a threaded boss in place of a plain one would have a somewhat restricted use. We are not certain, however, whether it would be an advantage to substitute your suggested part in place of the existing Threaded Crank (single arm). We are looking into this question and should we find that your suggested crank is a distinct improvement over the existing pattern, we will act accordingly. (*Reply to E. R. Veater, Merton, S.W.19*).

IMPROVED PLATE.—Contrary to increasing the adaptability of the 3½" × 2½" Flanged Plate, the addition of two extra flanges would tend to restrict its uses in quite a number of models. It is of course quite a simple matter to improvise a four-flanged 3½" × 2½" plate by bolting two 2½" Angle Girders to the existing double flanged article. (*Reply to J. Tomlinson, Chester*).

CURVED RACK.—Your suggested accessory would form quite a useful addition to the Meccano range. As will be seen in the sketch it would resemble an ordinary curved Strip with a number of ratchet teeth cut in one of its edges. A part of the type could of course be used in conjunction with the Pawl (part No. 147a) to form a quadrant control gear for limiting the movement of a brake lever, as for example in an automobile. We are of the opinion however, that standard Meccano accessories can be used in place of the suggested parts. Any suggestions that readers are able to offer regarding the uses to which a part of this type could be put, will be appreciated. (*Reply to R. M. Maxwell, Putney Hill, and J. Storer, Nottingham*).

Suggestions Section

Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(155)—A Mechanical Screwdriver: A Useful Model-building Tool

THE apparatus illustrated in Fig. 155 is designed to help in the erection or demolition of large Meccano structures.

Its assistance will prove most valuable, of course, in dismantling models, for a structure can be taken section by section and all nuts and bolts removed one after the other without stopping the Motor that drives the tool. The dismantling of some of the very large models, such as the Meccano Block-setting Crane, is naturally a lengthy task, but it may be speeded up and at the same time made much more interesting by means of the mechanical screwdriver.

The driving unit is the Meccano 6-volt Motor, the power of which is transmitted to the screwdriver unit through a flexible drive connection. A reduction ratio of 27 : 1 is employed between the armature spindle of the Motor and the shaft to which one end of the flexible drive is secured, the necessary reduction being obtained by the use of three ½" Pinions and a similar number of 57-teeth Gear Wheels. One of the Pinions is of course mounted on the armature spindle and meshes with a 57-teeth Gear on a short Rod journalled in the side plates of the Motor. This Rod carries also a second ½" Pinion that, in turn, engages with a 57-teeth Gear, and the latter is secured to another short Rod carrying a further ½" Pinion that meshes with the 57-teeth Gear on the final driven shaft.

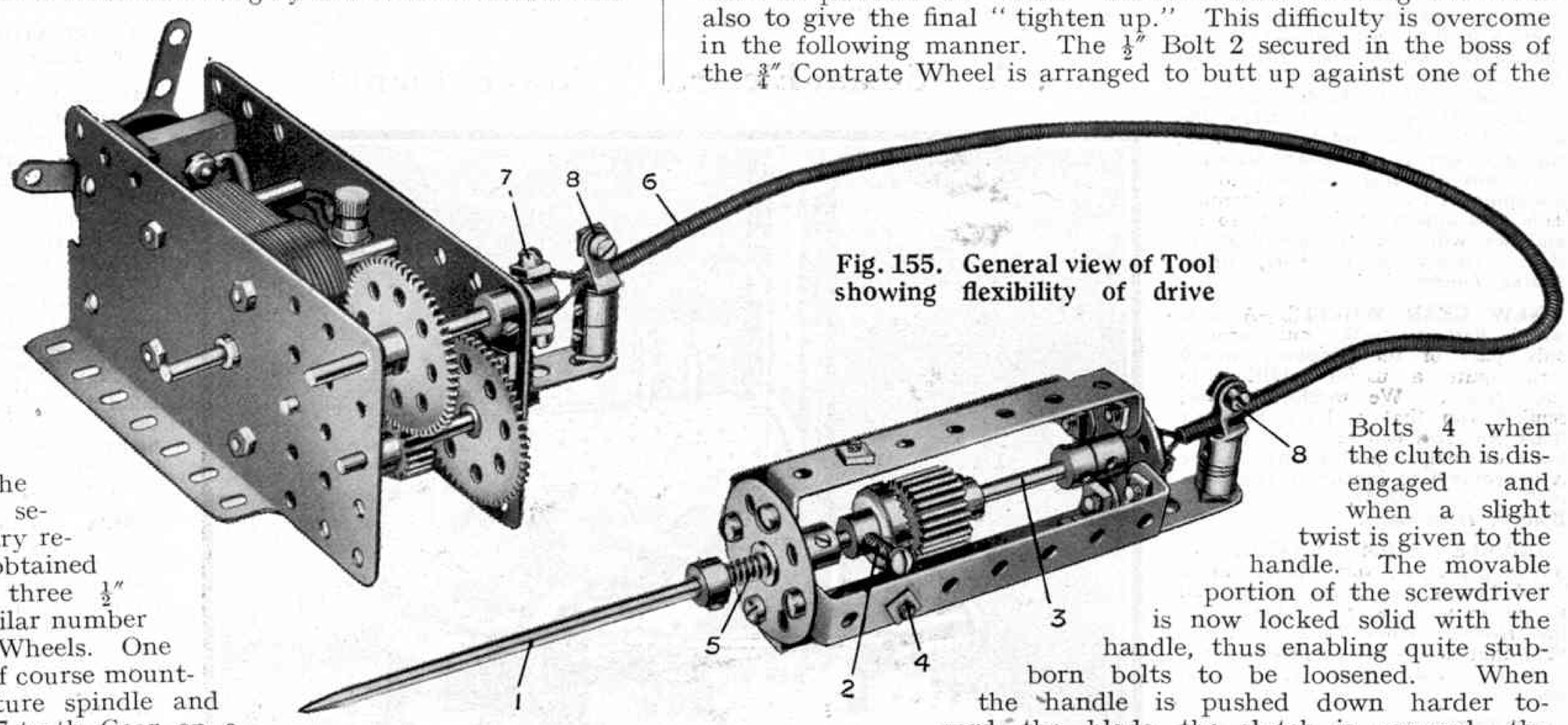


Fig. 155. General view of Tool showing flexibility of drive

The screwdriver itself consists of a suitable handle built up from three 3½" × ½" Double Angle Strips bolted to two Bush Wheels, the blade 1 being journalled in one Bush Wheel and the driving Rod 3 in the other. The screwdriver blade used in the device is obtained from the Special Screwdriver (part No. 36b); it will be found that, owing to its special construction, the handle of this part may be quite easily detached.

The blade carries at its inner end a ¾" Contrate Wheel which is secured in place by a ½" Bolt 2 inserted in one of its set-screw holes. On the inner end of the Rod 3 a ¾" diam. ¾" face Pinion is secured, which together with the Contrate, forms a clutch. This type of clutch is used in preference to the standard Dog Clutch because the end of the blade 1 may be journalled in the end of the Pinion, thus making the two parts more steady. A Compression Spring 5 pressing against the face of the Bush Wheel keeps the Contrate Wheel normally out of engagement with the ¾" Pinion.

The flexible driving connection transmitting the power of the Motor to the screwdriver consists of a piece of Bowden wire cable about 18" in length. (Bowden wire, which is used to operate the calliper brakes of bicycles and is also employed largely for the controls of motor cycles, may be obtained from most cycle dealers for a few pence). The outer case or "sheath" is cut about 2" shorter than the inner wire in order that the latter may project an equal amount at each end. The projecting ends are now divided into two equal portions, which are formed into loops so that bolts 7 may be passed through them and inserted in new-style Collars. One of the Collars is fitted to the driving Rod of the Motor and the other to the Rod 3 of the screwdriver. The sheath is clamped near each end between the jaws of End Bearings as shown.

As the Bowden cable will not transmit a large torque, a means must be provided to "start" the bolts when undoing them and also to give the final "tighten up." This difficulty is overcome in the following manner. The ½" Bolt 2 secured in the boss of the ¾" Contrate Wheel is arranged to butt up against one of the Bolts 4 when the clutch is disengaged and when a slight twist is given to the handle. The movable portion of the screwdriver is now locked solid with the handle, thus enabling quite stubborn bolts to be loosened. When the handle is pushed down harder toward the blade the clutch is engaged, the blade is rotated rapidly, and the bolt quickly extracted. Meccano boys should remember that they are following modern practice in employing mechanical tools for their model building.

(158)—A Novel Meccano Cam

(P. Kent, West Bridgford, Nottingham)

In nearly all types of internal combustion engines the valves are of the poppet type, which are held down on their seats by springs and lifted therefrom by means of cams. The reproduction of a successful cam mechanism with the aid of standard Meccano parts, in the course of building a model of a large gas engine, for instance, probably has taxed the ingenuity of many of our readers. Our contributor has solved this problem in a remarkably neat and effective manner.

A crank is bolted to a Wheel Flange in such a way that its boss does not coincide with the centre of the Wheel Flange but it is "off set" from the centre. The consequence is that the Wheel Flange revolves eccentrically about the shaft to which it is secured and so lifts the valve.

The bottom end of the valve spindle or tappet (if the model is equipped with the latter) is fitted with a roller pressing on the periphery of the Wheel Flange. The roller, in the case under consideration, consists of a Collar journalled on a ½" Bolt which is carried by a small Fork Piece. The boss of the small Fork Piece is secured rigidly by its set screw to the bottom end of the valve spindle, and a Compression Spring is placed on the valve spindle so as to return the valve to its seat.

(156)—Simple Dynamometer for Electric Motors

In practice it is often required to ascertain the power of an engine and for this purpose a device known as a dynamometer is employed. There are many different types of dynamometer, a simple kind being in the form of a band that passes round a pulley on the engine crankshaft. One end of the band is fixed immovably and the other is provided with an adjustable tensioning device that enables a varying braking effect to be placed on the pulley. By a simple calculation it may be shown that this braking effect is a measure of the horse power of the engine.

The model illustrated in Fig. 156 is intended primarily as a means of comparing the relative power of Meccano 6-volt Electric Motors. It is often difficult to judge the power of a Motor merely by retarding the armature spindle by gripping it between the fingers. With the model dynamometer shown in Fig. 156 however, an accurate comparison can be quickly made.

The framework of the model consists of two 7½″ Angle Girders connected together at each end by means of Channel Bearings; two 7½″ Strips are also secured to the top portions of the Channel Bearings.

A short Rod, journalled in the Channel Bearing at the far end of the model, has a ½″ fast Pulley 1 and a 1″ Gear Wheel 2 secured to it. A length of cord passes round the Pulley, one end being fastened to the frame of the model and the other end secured to a tension Spring. The Spring is attached to an End Bearing that is secured on the end of a 4½″ Screwed Rod. A Coupling is fixed to the Screwed Rod in the position shown and a 1″ Rod, secured in its upper lateral bore and resting on the edges of the 7½″ Strips, carries a Pointer 3. The latter registers against a scale consisting of a strip of white cardboard marked off into a number of equally spaced divisions as shown.

The end of the Threaded Rod is inserted in the tapped centre bore of the Octagonal Coupling 4 and by rotating the latter the length of the Rod and hence the tension of the cord round the Pulley may be adjusted. The Gear 2 is placed in mesh with a similar Gear on the armature spindle of the Motor and the tension adjusted by the Octagonal Coupling, until the Motor is turning slowly. The reading of the pointer on the scale is also noted, the higher the reading, i.e., the greater the tension on the spring, the greater the power of the Motor.

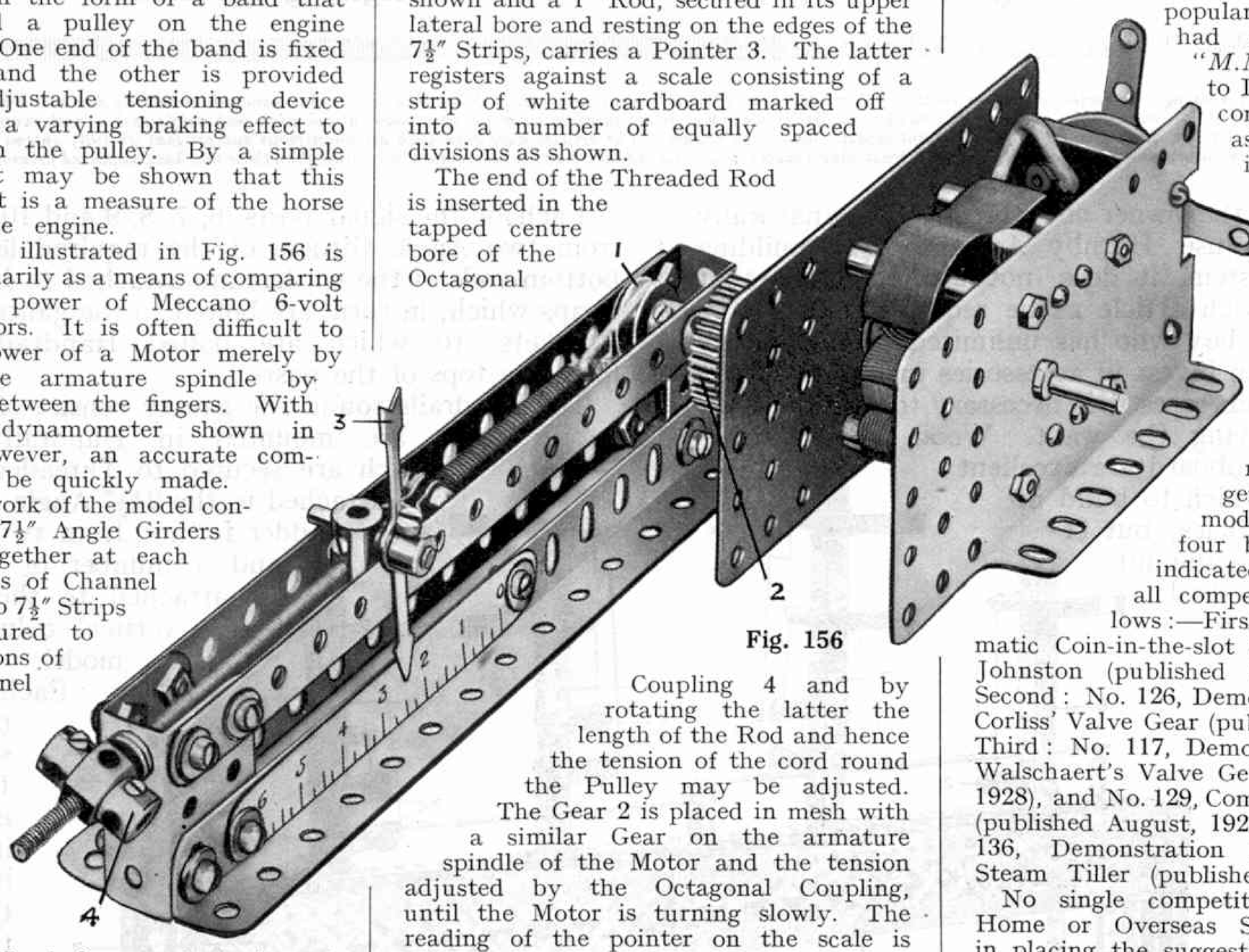


Fig. 156

(157)—Meccano Fishing Reel

(G. Muirhead and J. Lockett, Manchester)

At this time of the year our thoughts turn naturally from fireside hobbies to those that take us out in the fresh air, and as fishing undoubtedly is a popular outdoor pastime, the little accessory shown in Fig. 157 will prove useful to the Meccano boy who is also an amateur angler. The Meccano Reel shown functions in a remarkably efficient manner, and in many ways is equal to a fishing reel of a manufactured type.

The sides of the model consist of two 3″ Pulleys connected by three 1½″ Double Angle Strips. The Strip 1 holding the reel to the fishing rod, is bolted to the bottom Double Angle Strip and is attached to a second Double Angle Strip by means of a 1½″ Strip and Angle Bracket. The winding drum proper consists of two 2″ Pulleys 2 with bosses facing inwards secured to a 2½″ Rod, the space between the bosses of the Pulleys being taken up by two Collars and four Washers.

The end of the Rod is fitted with a Crank, a Threaded Pin forming a convenient handle. The ratchet brake controlling the rotation of the drum, consists of a Ratchet Wheel on the Rod engaging with a Pawl 3. The Pawl is mounted loosely on a Pivot Bolt locknutted to the 3″ Pulley, and is normally held in engagement with the teeth of the Ratchet by means of a short length of Spring Cord. When it is desired to make a cast, the Pawl is thrown out of engagement by the Threaded Pin that is secured in its boss. It will be noticed that a Washer is interposed between the Threaded Pin and the boss of the Pawl. This prevents the tip of the Threaded Pin binding on the shank of Pivot Bolt.

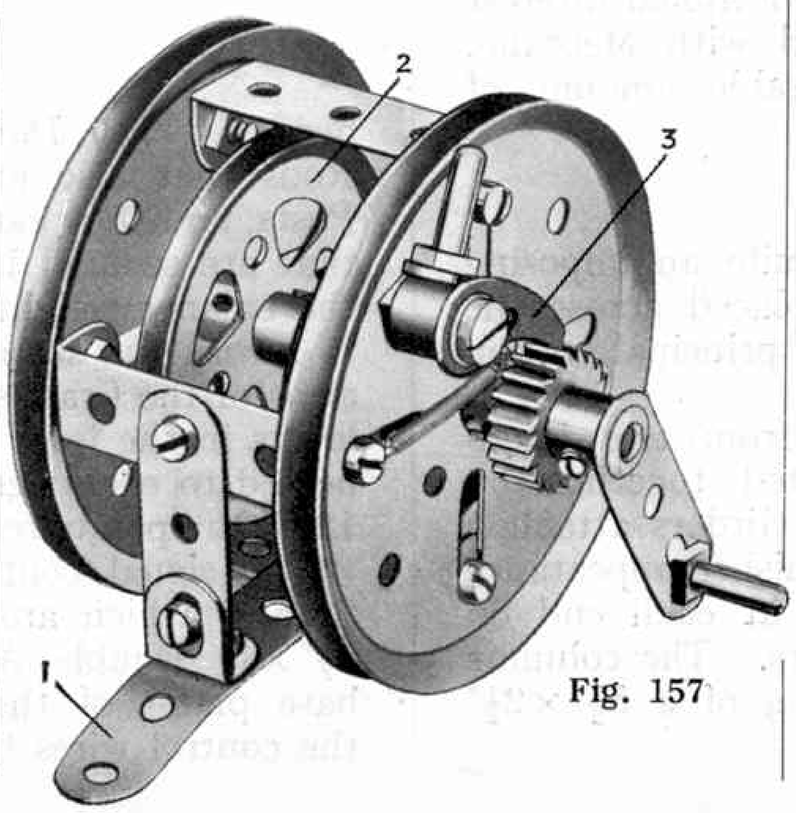


Fig. 157

Results of the "Suggestions Section" Voting Contest

Last December we announced an interesting Contest in connection with the "Suggestions Section." The object of the competition was to discover the most popular suggestion that had appeared in the "*M.M.*" from January to December 1928, and competitors were asked to write down, in order of merit, the four suggestions that they considered the best. A large number of entries were received, making the result as to which were the most popular suggestions, quite representative of the general opinion of model-builders. The four best suggestions as indicated by the votes of all competitors were as follows:—First: No. 139, Automatic Coin-in-the-slot Machine by A. M. Johnston (published November, 1928). Second: No. 126, Demonstration Model of Corliss' Valve Gear (published July, 1928). Third: No. 117, Demonstration model of Walschaert's Valve Gear (published April, 1928), and No. 129, Combination Safe Lock (published August, 1928). Fourth: No. 136, Demonstration Model of Brown Steam Tiller (published October, 1928).

No single competitor, either in the Home or Overseas Sections, succeeded in placing the suggestions in the correct order of merit, and the prizes were allotted therefore, by giving four points for each suggestion placed in the correct position, three points when it was one place out, and so on.

The names of the prize-winners will be found below. The figures in brackets denote the individual scores.

FIRST PRIZE (cheque value £1-1s.): William Sandys, Wandsworth, London, S.W.18 (14). THREE PRIZES (each consisting of cheque value 5/–): J. Knowles, Aldeburgh, Suffolk; James McGann, Fermoy, Co. Cork, Ireland; F. H. Jackel, Radlett (12). THREE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen; E. Reed, Hove; P. A. Rodgers, Sheffield, G. Wylde, Wigan (11). ONE PRIZE consisting of a 4-7 Instruction Manual: S. Hobday, Windsor (10). NINE PRIZES, each consisting of a copy of the Meccano Engineer's Pocket Book: A. Crawford, Edinburgh; W. D. Cripps, Luton; J. V. McGann, Fermoy, Co. Cork, Ireland; N. Blake, Fermoy, Co. Cork, Ireland; S. McGann, Fermoy, Co. Cork; J. H. Smyth, Greenock; R. Luton-Jones, Berwick; S. Slater, Pendleton, Manchester (9); Edward W. Barnworth, Birmingham (9).

Overseas Section

FIRST PRIZE (cheque to value £1-1s.): Colin Robertson, Canterbury, Victoria, Australia (13). Two PRIZES each consisting of a cheque value 5/6: B. C. King, Islington, Ont., Canada; J. M. Steeds, Christchurch, New Zealand (12).

Continued on page 425)

New Meccano Models

Five-Post Signal Gantry—Railway Wagon Weighing Machine

A little over a year ago the series of articles entitled "New Meccano Models" was commenced. Since then no less than ninety-four entirely new and original models have been illustrated. In choosing the models published we have endeavoured to cater for everybody (a well-nigh impossible task!) and examples of all sizes and types, from No. 00 to No. 7 Outfit models, have been shown. The articles have been such an unanimous success that we fully intend continuing them in future numbers indefinitely. We trust that readers will find the future articles even more interesting than those that have appeared previously.

ALTHOUGH the owner of a Hornby Train naturally prefers to use Hornby Accessories in building up his system, it does not always follow that he can obtain each article as he requires it (we have yet to meet the boy who has unlimited pocket money to spend, and can invest in accessories just as his fancy pleases!). In such cases it is necessary to employ other means of supplying the want. Wood, tin-plate and cardboard are excellent materials with which to build up the necessary articles, but of course, a certain amount of skill is needed in their manipulation. Building models with Meccano, however, is simplicity itself, and with a little care numerous railway accessories can be built up from standard parts. Two very interesting examples of this type of construction in Meccano are illustrated this month, the models shown having an additional interest for the boy who is purely concerned with Meccano, as they both incorporate a considerable amount of mechanism.

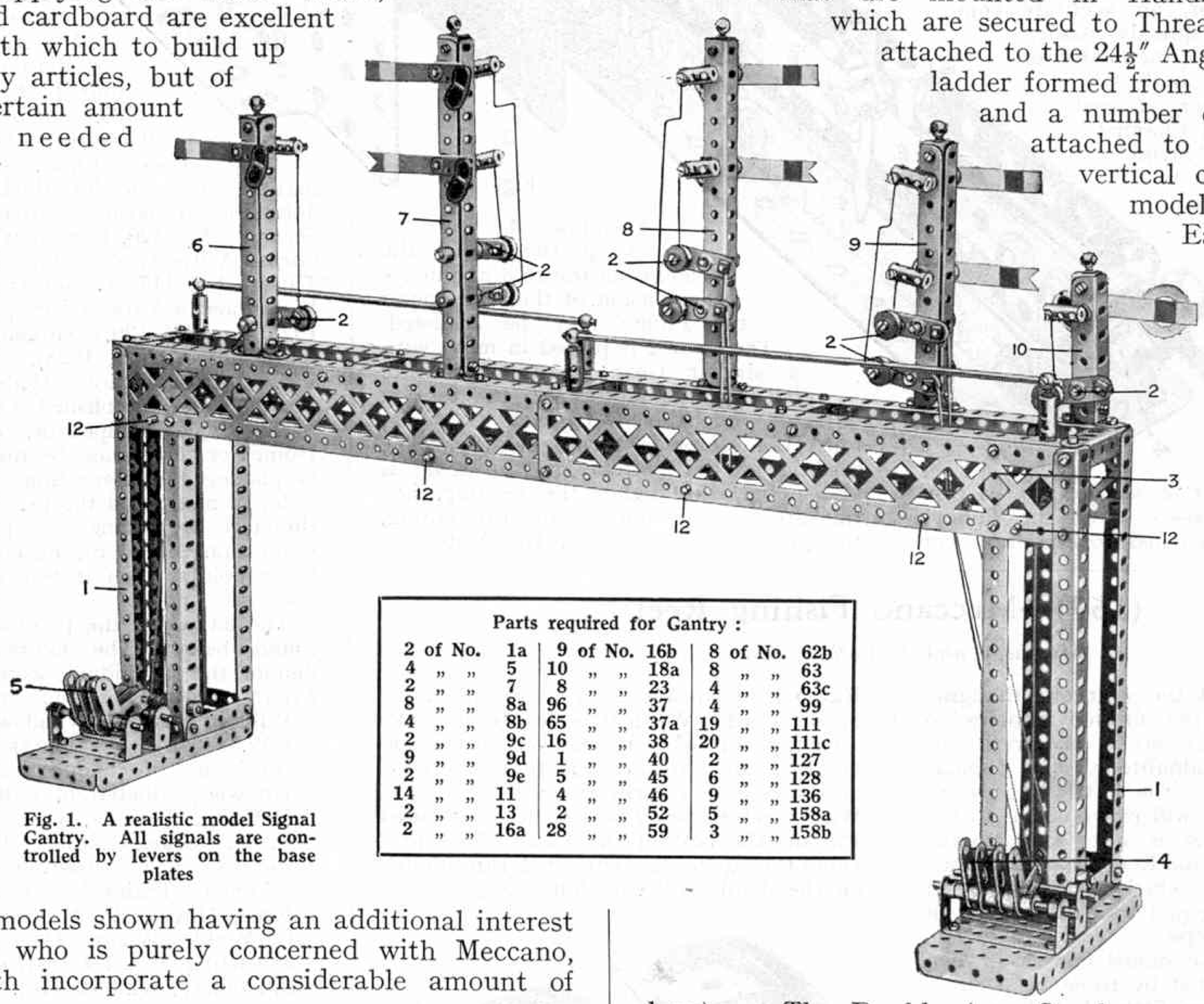


Fig. 1. A realistic model Signal Gantry. All signals are controlled by levers on the base plates

Parts required for Gantry:

2	of No.	1a	9	of No.	16b	8	of No.	62b
4	„ „	5	10	„ „	18a	8	„ „	63
2	„ „	7	8	„ „	23	4	„ „	63c
8	„ „	8a	96	„ „	37	4	„ „	99
4	„ „	8b	65	„ „	37a	19	„ „	111
2	„ „	9c	16	„ „	38	20	„ „	111c
9	„ „	9d	1	„ „	40	2	„ „	127
2	„ „	9e	5	„ „	45	6	„ „	128
14	„ „	11	4	„ „	46	9	„ „	136
2	„ „	13	2	„ „	52	5	„ „	158a
2	„ „	16a	28	„ „	59	3	„ „	158b

Railway Signal Gantry

The gantry shown in Fig. 1 has quite an imposing appearance, and would look well if placed across the main line just outside the terminus or principal station of the layout.

The gantry frame is constructed from two longitudinal $24\frac{1}{2}''$ Angle Girders, connected together by means of $2\frac{1}{2}''$ Angle Girders. Braced Girders attached to the sides of the $24\frac{1}{2}''$ Girders give a finished appearance to the structure, which is supported at each end on columns consisting of $9\frac{1}{2}''$ Angle Girders. The columns are each secured to a base consisting of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate.

Each of the signal posts (6, 7, 8, 9 and 10) is built up from two Angle Girders of the required length. The bottom ends of the Girders are attached to Double Bent Strips which, in turn, are bolted to the gantry. Double Brackets, to which are bolted Handrail Supports, form the tops of the posts.

The handrails round the gantry consist of $11\frac{1}{2}''$ Rods that are mounted in Handrail Supports, which are secured to Threaded Couplings attached to the $24\frac{1}{2}''$ Angle Girders. A ladder formed from two $9\frac{1}{2}''$ Strips and a number of $\frac{3}{4}''$ Bolts is attached to the left hand vertical column of the model.

Each of the signal arms is secured on a 1″ Rod that is journalled in holes in its respective post. On the opposite ends to the arms these Rods carry Couplings to form cranks that are connected by wire to one arm of the Double Arm Cranks 2 (Meccano Bare Copper Wire No. 315 is the most suitable for use here). The Double Arm Cranks are pivoted on 1″ Rods that also are journalled in holes in the Signal Posts, and they carry in their end holes $\frac{1}{2}''$ Loose Pulleys that are secured by $\frac{1}{2}''$ Bolts. These Pulleys represent the balance weights of an actual signal, which are used to return the signal to the danger position. The other arms of the Cranks are connected by wire to the control levers in the lever frames 4 and 5, one lever being connected to each signal. The cords are led over 3″ Rods 12 to the points required.

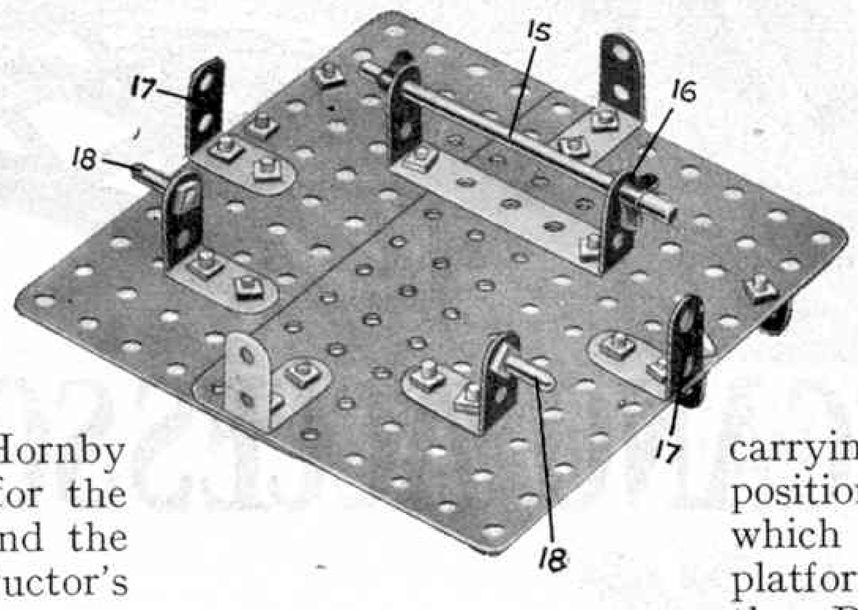
The signal control levers are formed by Boss Bell Cranks, which are mounted on 3″ Rods journalled in $2\frac{1}{2}'' \times 1''$ Double Angle Strips that are bolted to the base plates of the model. The method of arranging the control wires to the various signals is quite clear in

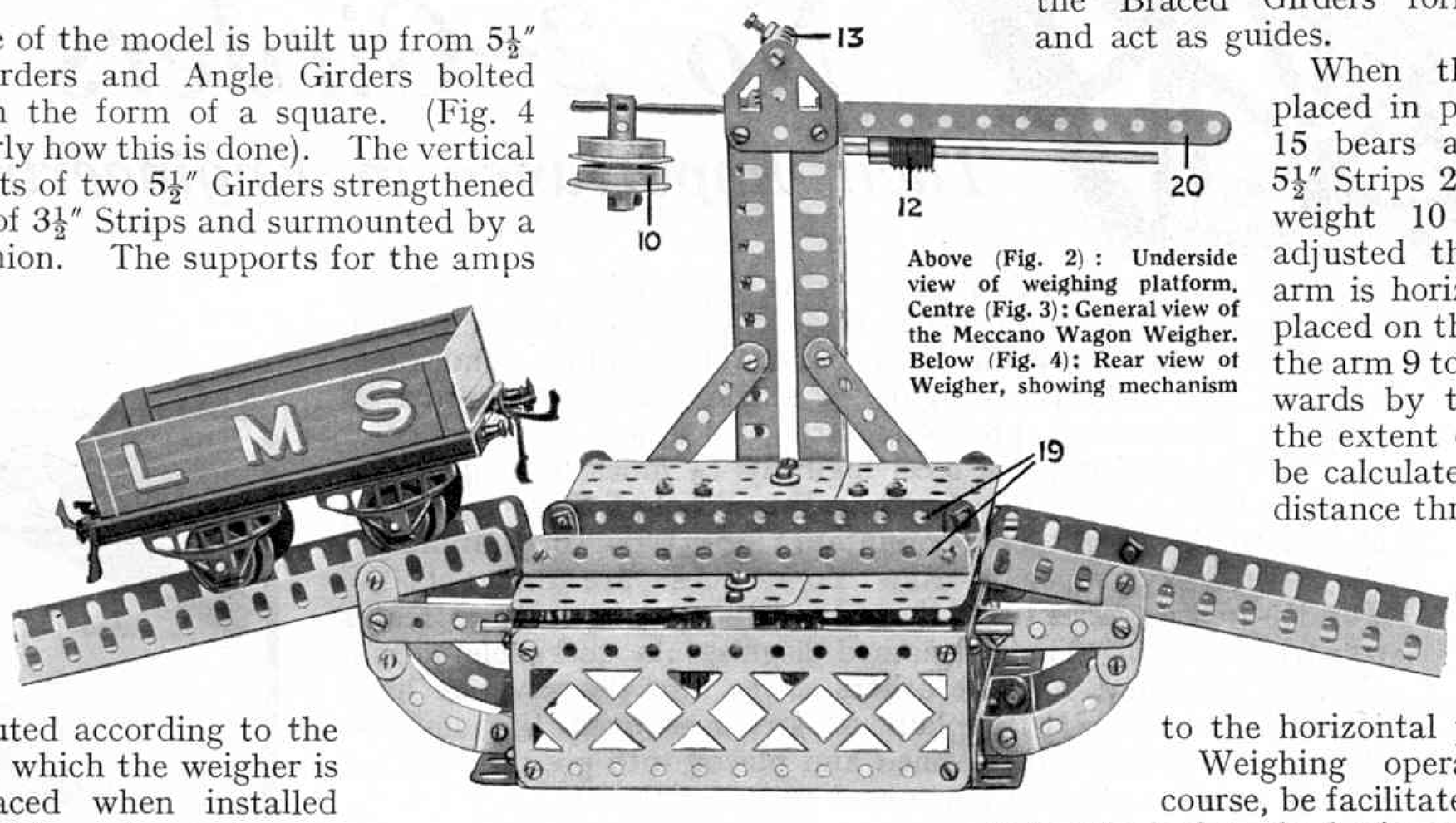
the illustration. A 3″ Rod mounted horizontally behind the control levers keeps the latter in a uniform position when the signals are at danger.

Railway Wagon Weigher

Apparatus somewhat similar to the model shown in Fig. 3 is often to be found in goods yards where it is necessary to keep a careful check on the contents of each truck. The Meccano model can be made to record the weights of Hornby trucks, etc., quite accurately and will form an interesting addition to a layout. Hornby rails can, of course, be substituted for the Angle Girders forming the ramps, and the gradient lessened to suit the constructor's layout.

The base of the model is built up from 5½″ Braced Girders and Angle Girders bolted together in the form of a square. (Fig. 4 shows clearly how this is done). The vertical post consists of two 5½″ Girders strengthened by means of 3½″ Strips and surmounted by a Flat Trunnion. The supports for the amps consist of 2½″ Strips and Curved Strips bolted to the sides of the base, but any suitable support may be substituted according to the position in which the weigher is finally placed when installed in the model goods yard.

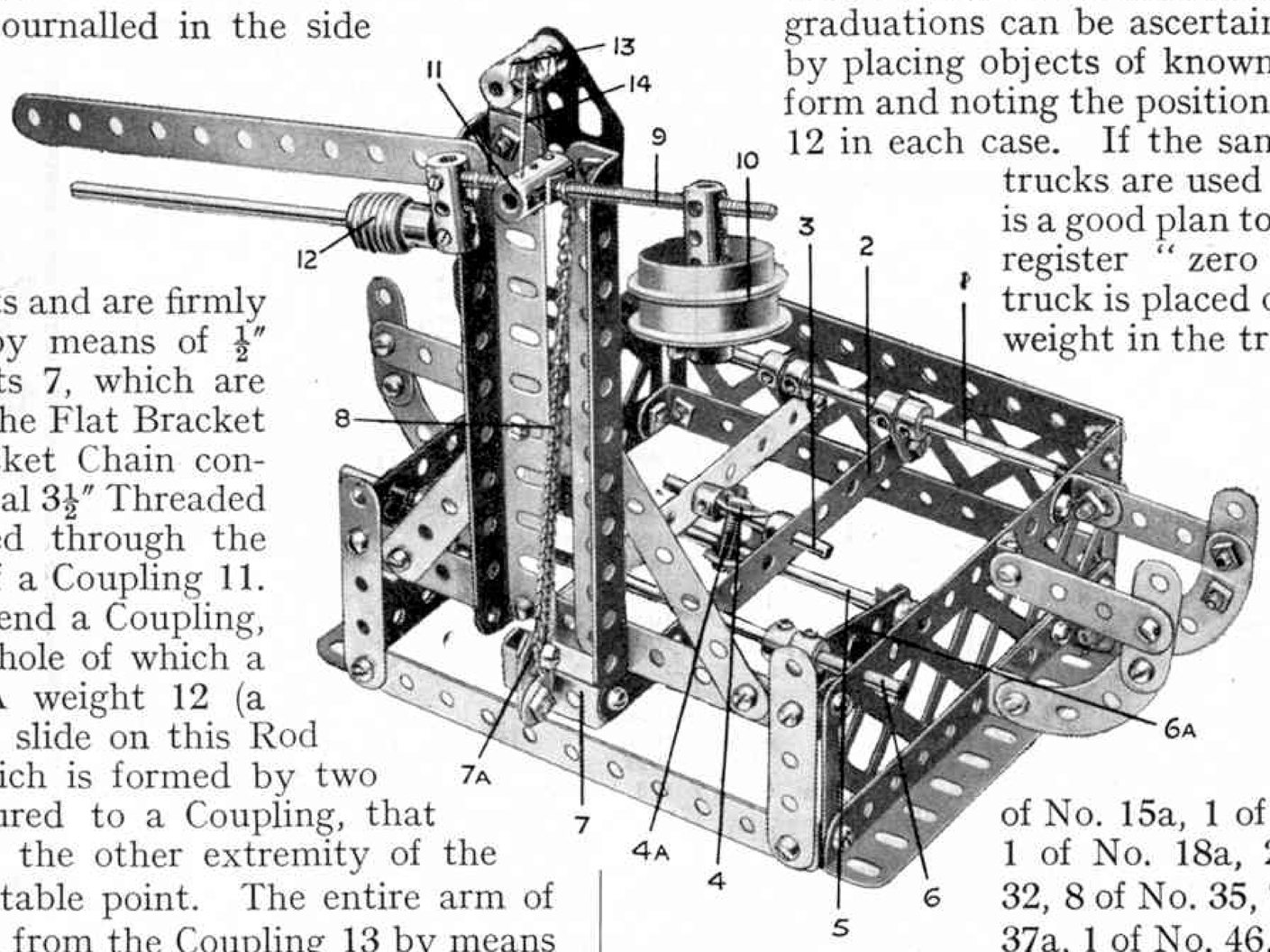




Above (Fig. 2): Underside view of weighing platform. Centre (Fig. 3): General view of the Meccano Wagon Weigher. Below (Fig. 4): Rear view of Weigher, showing mechanism

The Rod 1 (Fig. 4) journalled in the side Girders is held in position by Spring Clips and carries two Flat Brackets, which are held loosely by Collars. The 5½″ Strips 2 are bolted to the Brackets and are firmly secured at their ends by means of ½″ Reversed Angle Brackets 7, which are bolted on either side of the Flat Bracket 7a. A length of Sprocket Chain connects this to the horizontal 3½″ Threaded Rod 9, which is passed through the centre transverse hole of a Coupling 11. The Rod carries at one end a Coupling, in the lower transverse hole of which a 4½″ Rod is secured. A weight 12 (a Worm Wheel) is free to slide on this Rod and another weight which is formed by two Flanged Wheels is secured to a Coupling, that may be threaded on to the other extremity of the balance arm, at any suitable point. The entire arm of the balance is suspended from the Coupling 13 by means of a piece of strong silk 14 passed through the end transverse holes of the Coupling 11.

The 2″ Strips 6a are held securely on the Rod 6 by means of Collars, and carry in their outer ends a Rod 5 that passes under the Strips 2. A Double Bracket 4 is passed over the Rods 3 and 5 and held in place by a ¾″ Bolt 4a.



The platform carrying the rails, consists of two 5½″×3½″ Flat Plates overlapped and bolted together, the rails 19 being built up from 5½″ Angle Girders. A 2½″×1″ Double Angle Strip 16 carrying a 3½″ Rod 15 is bolted to the underside of the platform (see Fig. 2), and two 1″×1″ Angle Brackets carrying threaded pins 18 are bolted in the position shown. The Angle Brackets 17 which are bolted at each side of the platform rest against the inner sides of the Braced Girders forming the base and act as guides.

When the platform is placed in position the Rod 15 bears against the two 5½″ Strips 2 (Fig. 4) and the weight 10 should be so adjusted that the balance arm is horizontal. A truck placed on the rails 19 causes the arm 9 to be pulled downwards by the chain 8 and the extent of the load may be calculated by noting the distance through which it is necessary to move the weight 12 in order to return the arm to the horizontal position.

Weighing operations will, of course, be facilitated if a graduated scale is attached to the horizontal arm 20. The graduations can be ascertained in the first place by placing objects of known weight on the platform and noting the position of the sliding weight 12 in each case. If the same or exactly similar trucks are used for each "weigh," it is a good plan to cause the machine to register "zero" when the empty truck is placed on the platform. The weight in the truck will then be indicated directly. Parts required to build this model are: 7 of No. 2, 2 of No. 4, 4 of No. 5, 4 of No. 6, 6 of No. 6a, 4 of No. 8, 4 of No. 9, 9 of No. 10, 1 of No. 11, 8 of No. 12, 6 of No. 12a, 2 of No. 14, 2 of No. 15a, 1 of No. 16, 1 of No. 17, 1 of No. 18a, 2 of No. 20, 1 of No. 32, 8 of No. 35, 76 of No. 37, 5 of No. 37a, 1 of No. 46, 2 of No. 48, 4 of No. 48d, 2 of No. 52a, 13 of No. 59, 4 of No. 63, 1 of No. 80a, 4 of No. 90a, 6″ of No. 94, 3 of No. 100, 1 of No. 111, 1 of No. 111c, 2 of No. 115, 2 of No. 125, 1 of No. 126a.

MECCANO ACCESSORY PARTS

No. 2–Girders

Their Importance in Engineering

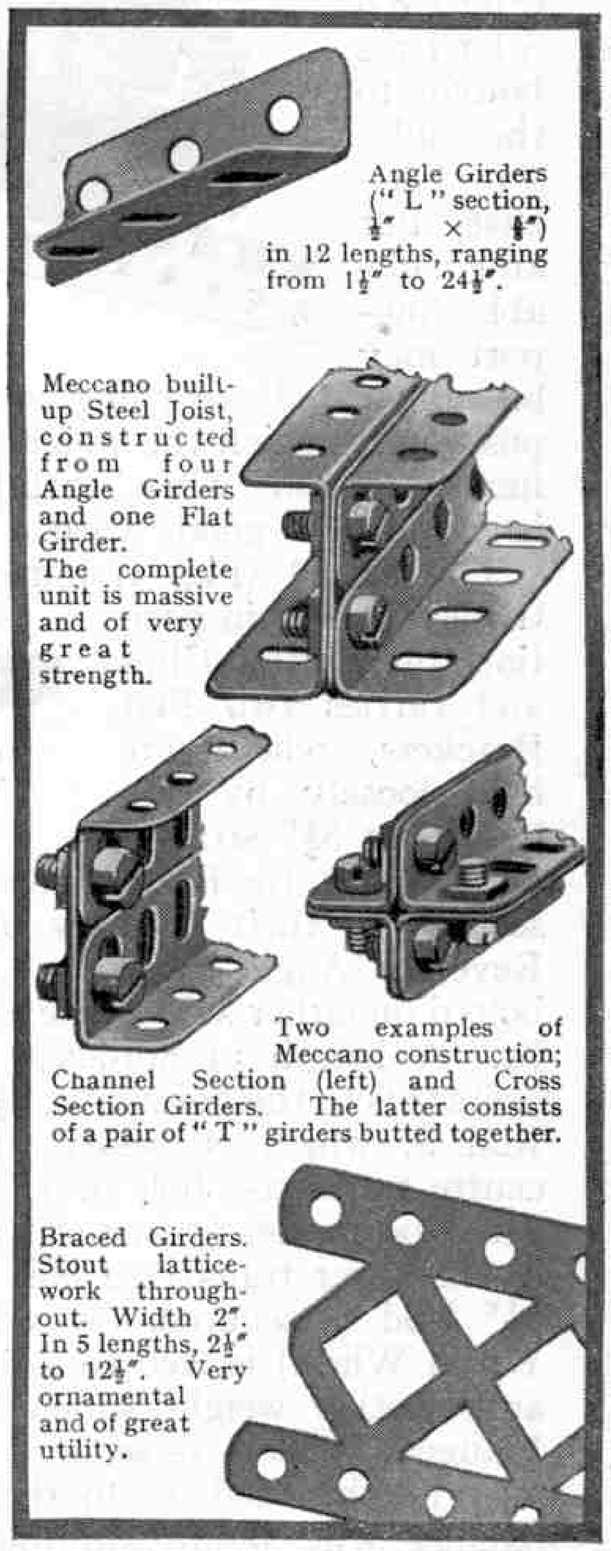
The greatest works of engineering depend for their strength and durability upon the massive girders of steel which, though sometimes hidden by an outer casing of masonry, bind them together and hold them rigid. A single rolled steel girder, if properly constructed, proves as strong as a wall of masonry.

The Forth Bridge, a steel highway 1½ miles in length, suspended high above the Forth; the Eiffel Tower, extending almost to the height of a mountain; the Woolworth Building, the tallest skyscraper in New York—these are three of the world's greatest structures that stand like monuments to man's constructive skill. The last named disguises its steel skeleton in a cloak of masonry, but the others tower into the sky like huge Meccano models. It is plain to see how even the smallest strut or tie is carefully planned and placed into position so that it may bear its allotted portion of strain or thrust.

Meccano Girders fulfil the same important duty in Meccano engineering. They are fitted into models and braced by Strips or Rods until the finished structure would support a man's weight, without the slightest disruption. Meccano Girders are made of the finest steel, and are beautifully enamelled in green. The edges and corners are rounded and smoothed off, while the perfect accuracy of their manufacture makes them invaluable in the construction of even the most intricate mechanisms.

No.			s.	d.
1.	Perforated Strips,	12½″ long ... ½ doz.	1	0
1a.	„ „	9½″ „ ... „	0	9
1b.	„ „	7½″ „ ... „	0	8
2.	„ „	5½″ „ ... „	0	6
2a.	„ „	4½″ „ ... „	0	5
3.	„ „	3½″ „ ... „	0	4
4.	„ „	3″ „ ... „	0	3
5.	„ „	2½″ „ ... „	0	3
6.	„ „	2″ „ ... „	0	3
6a.	„ „	1½″ „ ... „	0	3
7.	Angle Girders,	24½″ „ ... each	0	8
7a.	„ „	18½″ „ ... „	0	6
8.	„ „	12½″ „ ... ½ doz.	1	9
8a.	„ „	9½″ „ ... „	1	3
8b.	„ „	7½″ „ ... „	1	2
9.	„ „	5½″ „ ... „	1	0
9a.	„ „	4½″ „ ... „	0	10
9b.	„ „	3½″ „ ... „	0	8
9c.	„ „	3″ „ ... „	0	8
9d.	„ „	2½″ „ ... „	0	7
9e.	„ „	2″ „ ... „	0	6
9f.	„ „	1½″ „ ... „	0	6
55.	Perforated Strips, slotted, 5½″ long	each	0	2
55a.	Perforated Strips, slotted, 2″ long	„	0	1
89.	5½″ Curved Strips, 10″ radius	„	0	2
89a.	3″ „ „ cranked, 1¾″ radius, 4 to circle ...	„	0	2

No.			s.	d.
90.	2½″ Curved Strips, 2⅜″ radius	each	0	1
90a.	2½″ „ „ cranked, 1½″ radius, 4 to circle ...	„	0	1
97.	Braced Girders, 3½″ long ...	½ doz.	0	9
97a.	„ „ 3″ „ ...	„	0	8
98.	„ „ 2½″ „ ...	„	0	8
99.	„ „ 12½″ „ ...	„	2	6
99a.	„ „ 9½″ „ ...	„	2	0
99b.	„ „ 7½″ „ ...	„	2	0
100.	„ „ 5½″ „ ...	„	1	0
100a.	„ „ 4½″ „ ...	„	0	10
103.	Flat Girders, 5½″ „ ...	„	0	10
103a.	„ „ 9½″ „ ...	„	1	2
103b.	„ „ 12½″ „ ...	„	1	3
103c.	„ „ 4½″ „ ...	„	0	9
103d.	„ „ 3½″ „ ...	„	0	7
103e.	„ „ 3″ „ ...	„	0	6
103f.	„ „ 2½″ „ ...	„	0	5
103g.	„ „ 2″ „ ...	„	0	4
103h.	„ „ 1½″ „ ...	„	0	4
103k.	„ „ 7½″ „ ...	„	1	0
113.	Girder Frames (triangulated truss type)	each	0	3
143.	Circular Girders, 5½″ diam. "L" section	„	1	0
145.	Circular Strips, 7″ diam. over all	„	0	9



All the above parts are richly enamelled in colours.

YOUR DEALER WILL BE PLEASED TO SHOW YOU ALL THE MECCANO PARTS. ASK HIM FOR A COMPLETE PRICE LIST.

MECCANO LTD. - OLD SWAN - LIVERPOOL

Second "Lynx-Eye" Competition

ANOTHER OBSERVATION TEST FOR SHARP-EYED MODEL-BUILDERS

CAN YOU IDENTIFY THESE PUZZLE PICTURES?

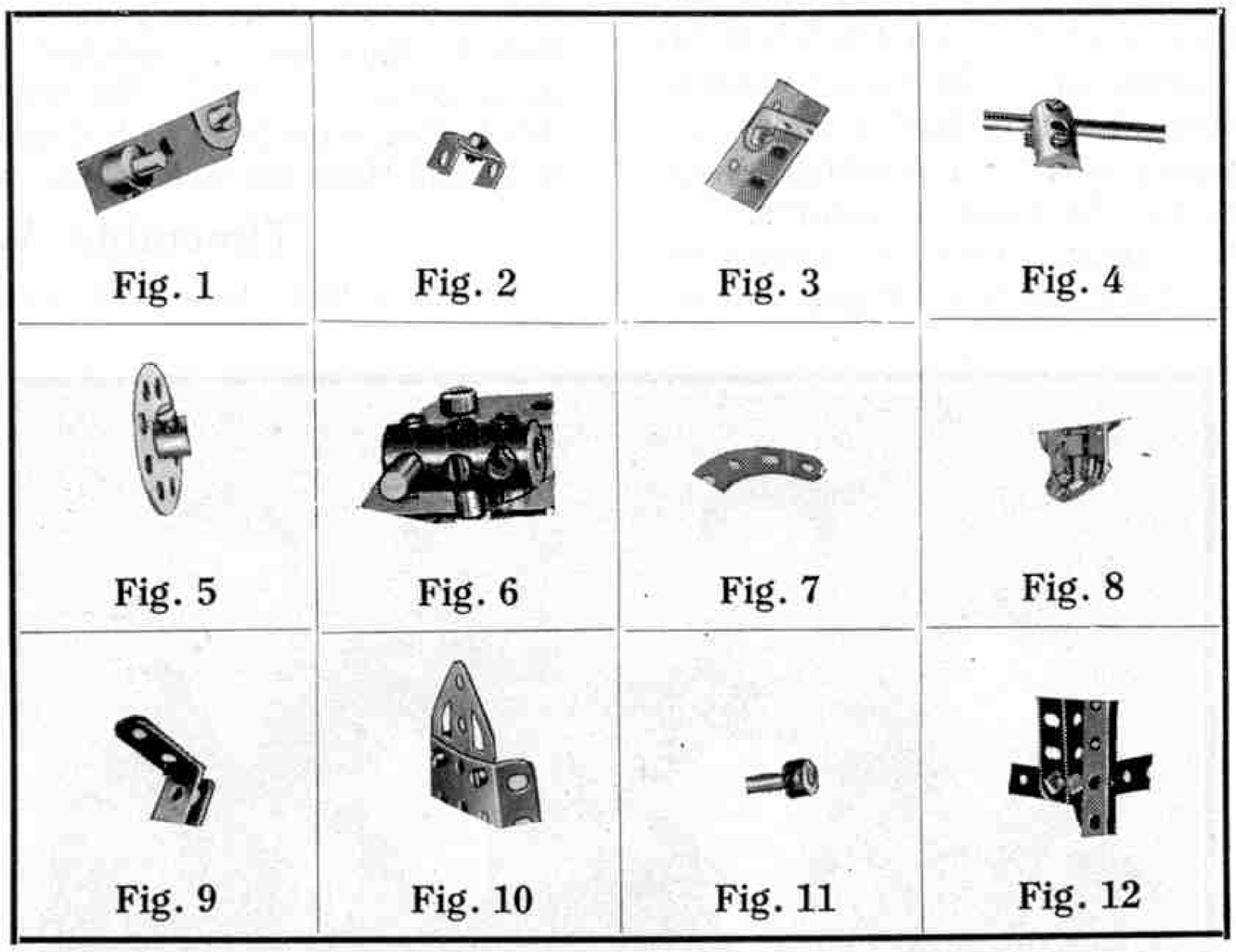
This month we are announcing the second competition in the new "Lynx-Eye" series, the first competition being published last month. The series will be completed by two more competitions, to appear in the June and July issues of the "*M.M.*"

A number of splendid prizes will be awarded for the best entries in each individual contest, and in addition, three special prizes consisting of Meccano products to the value of £3-3s., £2-2s., and £1-1s., will be awarded to competitors who succeed in solving the largest number of pictures in the complete series. So those readers who entered the first contest of this series should not fail to enter this one and the two that will follow.

The twelve fragmentary pictures illustrated herewith have all been cut from either the 00-3 or 4-7 Manuals, and what you have to do is to find out from which model each of the twelve pictures shown has been taken.

Although the task of identifying each "fragment" may at first appear very difficult, a careful inspection of the separate Manual models will soon enable you to "spot" from where quite a number of the illustrations have been taken.

The parts included in the fragments will in nearly every case provide valuable "clues" in solving the puzzle. If, for instance, the picture contains part of a Coupling or Gear Wheel it can only have been taken from one of the large models, so the search is narrowed down immediately. Do not be discouraged because you cannot solve all the pictures. You may quite easily obtain one of the prizes offered although your entry is not absolutely correct.



The contest will be divided into two sections—Section A for readers residing in the British Isles, and Section B for readers residing Overseas.

Prizes will be awarded in the Second Lynx-Eye Competition as follows: First Prize: Meccano products to the value of £1-1s.; Second Prize to value 15/-; Third Prize to value 10/6. Twelve copies of "Famous Trains" by C. J. Allen will also be awarded in each section. If no competitor succeeds in numbering all the models the prize will be given to the reader who sends in the best attempt. Should more than one competitor solve all twelve puzzles correctly the prizes will be awarded to the first examined.

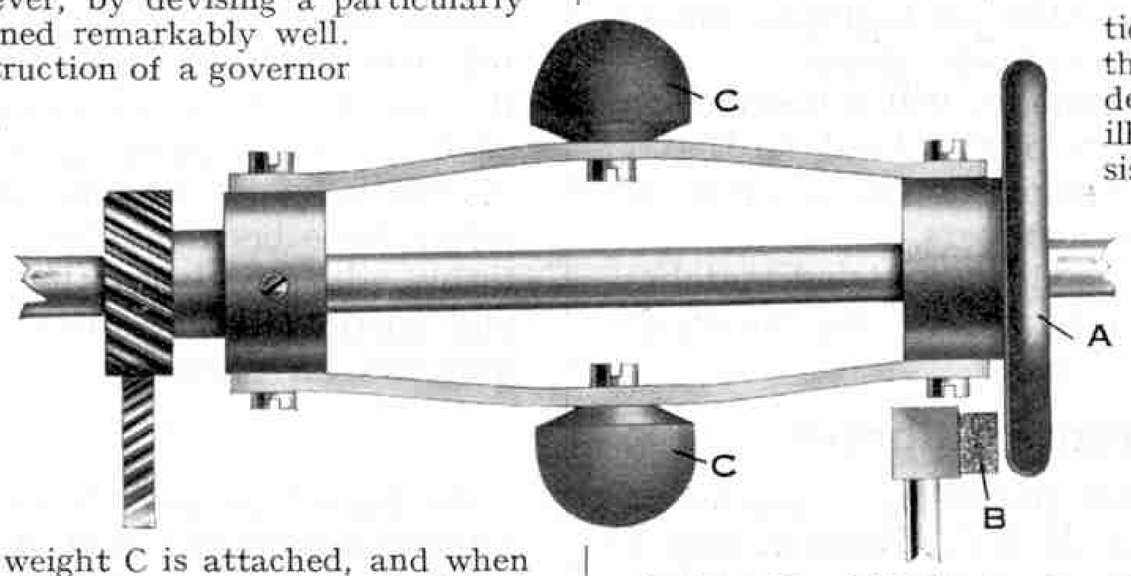
As you solve each picture write down carefully on a post card, first the number of the picture and then the number of the model from which it is taken. The post card must in addition contain your name, age and full address together with the Section in which you are entering. Address post cards "Second Lynx-Eye" Competition, Meccano Ltd., Old Swan, Liverpool. Entries for Section A must reach this office not later than 31st May, 1929, and for Section B not later than 31st July, 1929.

A PROBLEM FOR MODEL-BUILDERS

It has always been claimed that every movement known to mechanical engineering can be reproduced in Meccano, but nevertheless we were somewhat puzzled when asked how a spring centrifugal governor similar to that shown in the illustration, could be devised from Meccano parts. One of our model-building experts happily saved the situation, however, by devising a particularly neat spring governor that functioned remarkably well.

It occurred to us that the construction of a governor of this type would form an excellent test for the ingenuity of model-builders. We have therefore included this illustration of a manufactured type so that readers may try their hand at building one to their own ideas.

The mechanism consists essentially of two collars held together by thin springs, one collar being fastened to the rod, whilst the other can slide up and down and carries a metal disc A. To the centre of each strip a heavy lead weight C is attached, and when the whole is rotated by means of the gears shown, the weights C tend to fly out through centrifugal force, and in doing so move the sliding collar and disc A longitudinally on the rod. On reaching a certain position A comes into contact with the fibre pad B held on an adjustable arm, and the friction created limits the speed of the motor. The device is to be found in any gramophone for controlling the speed at which the turntable rotates.



To the reader who sends us particulars (photographs or drawings) of the neatest and most efficient governor designed on similar lines to the illustration we will award a prize consisting of Meccano products to the value of 10/6. In addition a copy of "Famous Trains" by C. J. Allen (Meccano Library No. 1) will be forwarded to each of six competitors who are next in order of merit.

The contest will be divided into two Sections: Section A for competitors residing in the British Isles; Section B for competitors residing Overseas. Closing dates, for Section A: 29th June, 1929. Section B: 30th September, 1929. Address entries "Governor" Contest, Meccano Ltd., Old Swan, Liverpool.

Summer Activities

We are now approaching the time of the year when too much indoor work becomes irksome, even though it be connected with the fascinations of model railway operation. Many H.R.C. Branches have realised this already, and have commenced preparations for a combination of indoor and outdoor work for the summer months.

Now is the time for arranging visits to places of railway interest in the locality, such as engine sheds, goods yards, etc. As a rule there is little difficulty in obtaining permission for such visits, provided that sufficient notice is given to the authorities concerned. Application should be made by the Chairman or the secretary of the Branch, stating exactly what is required and the number of members who will make up the party.

When permission has been received and the date of the visit settled, the various details should be followed out exactly. The party should be at the starting point punctually, and the number agreed upon should not be exceeded, as this often causes inconvenience to the authorities who have arranged for a certain number. One other point of importance is that no attempt should be made to take photographs unless permission to do so has been expressly given.

I hope that secretaries of Branches will remember to send me an account of any visits of this kind, so that I may publish a summary of them for the interest of other Branches and of "lone members."

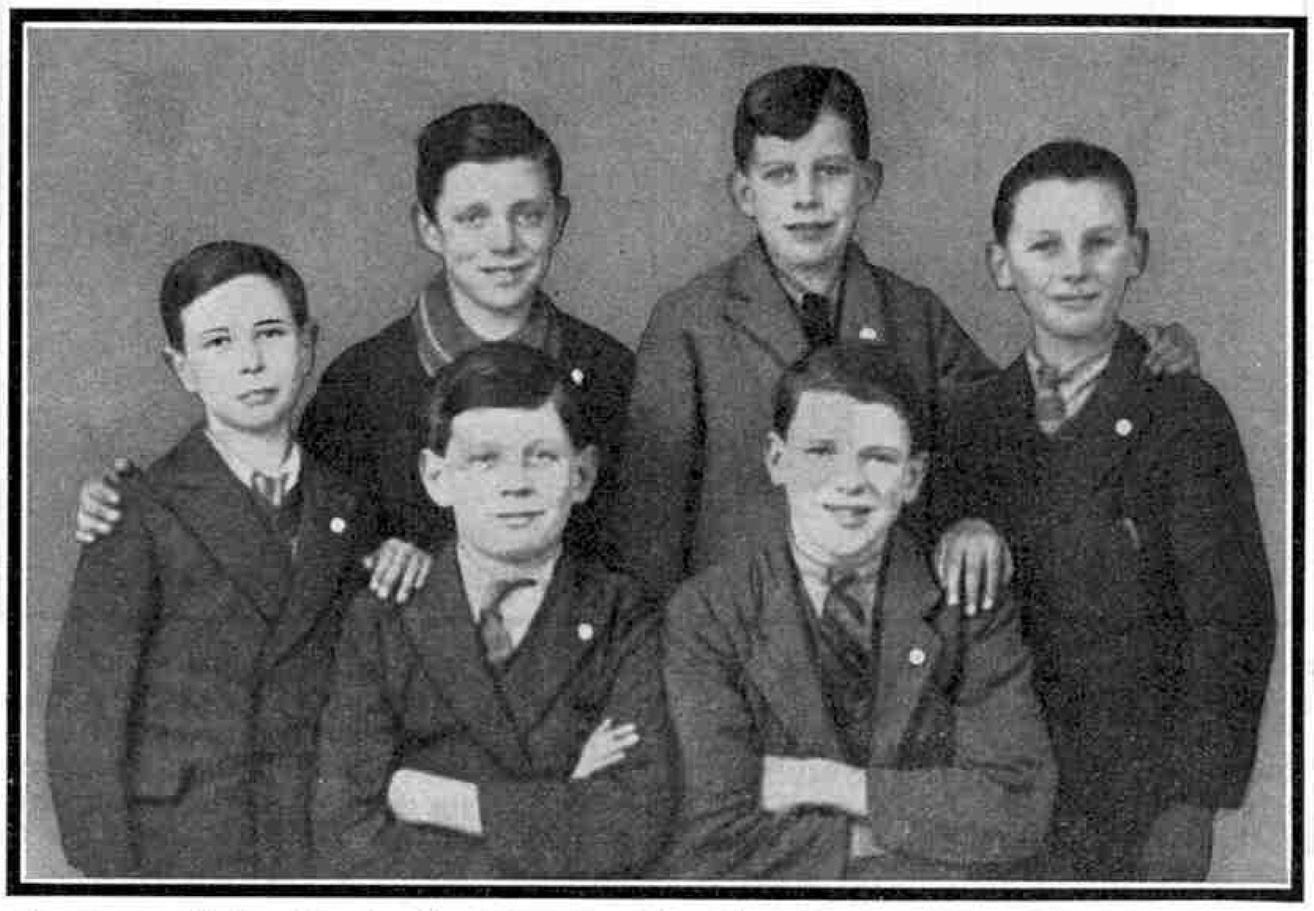
Several Branches are arranging also for cricket matches and outings of various kinds to fill in the intervals between purely railway functions.

Forming a Reference Library

The formation of a reference library is a matter of considerable importance to a H.R.C. Branch and I am glad to see that a good deal of interest is being taken in this work. Of course financial considerations play an important part here, but I am sure that every Branch can build up gradually a small library of standard books on both model and real railways. Fathers and uncles usually may be persuaded to assist in this direction if they are approached tactfully when they are in a good humour! The daily papers often contain interesting reports and photographs connected with railways and these are well worth cutting out and preserving.

Timetable Working

When a Branch is first formed it has many things to occupy its time and attention. In particular it has to take stock of the railway material at its disposal and to decide upon the nature and extent of its layout. In the normal course of things the next step is to appoint the various officials to operate the railway and thus prepare for the greatest fun and excitement of all—timetable working. It is, of course, quite interesting to run two or three trains around a good-sized layout without any particular method; but for real excitement nothing can compare with running trains to a definite schedule.



Members of the Montpelier Branch, No. 11. Secretary, R. W. Blackmore; General Manager, Thomas Baker. This Branch has made good progress since its incorporation and now has an excellent layout and an interesting library

The timetable must of course be worked out in advance, with careful consideration of the engines and rolling stock available, and the distance each engine will run with one winding with a certain load behind it. In order to avoid any confusion at critical moments, each of the operating officials should have written instructions to follow, and to simplify this special forms have been prepared for H.R.C. Branches. These forms add greatly to the interest of timetable working, and particulars and prices may be obtained from Headquarters on request.

* * * *

In regard to reports of Branch activities, I wish to remind secretaries that it is necessary that the report for each month should be sent in to reach me not later than the fifth of the following month, and if possible earlier.

Branch Notes

SUTTON AND DISTRICT.—We regret to have to report the illness of the Chairman of this Branch, and we hope he is now well on the road to recovery. The Underground Railway Company kindly lent sets of lantern slides entitled "*The Story of London's Underground*" and "*The Story of the London Omnibus*," and these were used in connection with lectures given by members.

EXHALL.—Each member has been allotted part of the equipment to look after. This gives a feeling of responsibility that is all to the good in maintaining interest and enthusiasm. One night was spent in testing the pulling powers of the locomotives, while several working timetables have been compiled and successfully put into operation. A Whist Drive provided a very enjoyable evening.

NEW EARSWICK.—A system of electrical control has been installed throughout the Branch layout and so arranged that the Line Superintendent may communicate with each station. Working timetables are in use, these being made out on the pads supplied by Headquarters. Cricket matches and other games are being arranged.

GLOUCESTER.—Mr. T. W. Clark has been appointed Chairman and G. T. Clark secretary. Members met at the G.W.R. Locomotive Sheds for a prearranged tour, which began with an inspection of the "*Crumlin Hall*," one of the new "Hall" class locomotives (4–6–0 type). Several other giant G.W.R. engines also were inspected. Lectures have been given by the local shunter and the signalman, and these were much appreciated by those present. The Branch is arranging to visit the G.W.R. shunting yards and Pumping Station.

NOTTINGHAM.—Tests have been made by the secretary to ascertain the number of trucks the 4–4–4 Tank locomotives will pull at an average speed. Twelve wagons were hauled with ease, a result that is highly satisfactory. A new layout is to be laid on shelves secured to the walls of the club room. A Hornby Metropolitan H.V. locomotive has been placed in service, the current for which is obtained from the electric lighting installation.

1ST CROYDON (ADDISCOMBE) WOLF CUBS.—Various layouts have been tested and official signalmen and pointsmen appointed. The official staff were successful in running eleven trains simultaneously—a very good performance. Arrangements are being made to visit the Model Railway Exhibition, which should prove very interesting.

ELLESMERE.—The Branch has inspected the running sheds at Nine Elms on the Southern Railway. The formation of an interesting library will no doubt be of great assistance to members desirous of extending their knowledge of model railways. A visit is to be made to the running sheds at Camden (L.M.S.R.), when we hope the secretary will have something interesting to report.

BROOKFIELD.—Has made good progress since its incorporation. A levy of one halfpenny per week has been placed on members, which will be used to start a fund for purchasing railway periodicals each month.

FARNHAM (SURREY).—A large set of rolling stock is now available and many enjoyable evenings have been spent. Two large goods yards are to be joined on to the main track and these will make the general layout look much more realistic. New Hornby Rolling Stock is to be purchased out of the Branch funds, from which fact it would appear that the Branch is in a sound financial condition.

ELM PARK.—Good progress has been made during the last month, the keenness of the members and the attendance being very satisfactory. Engine drivers and other officials have been appointed and a good working timetable is now in operation.

THE PARK (SELLY OAK).—Owing to the illness of various members several meetings have had to be abandoned. New layouts have been tried out, with the object of finding one on which all trains can be worked together. A special night has been set apart for reading interesting books in the library that has lately been formed.

Happy days! Jack N. Kennedy, of Toronto, Canada, indulges in a little "carriage exercise" by way of a change from his railway activities

Further H.R.C. Incorporated Branches

29. BLACKPOOL (NORTHERN SECTION)—C. B. Band, "Baslow," Mossom Lane, Norbreck, Blackpool.
30. ELM PARK (KILLYLEA)—H. B. Thomson, Elm Park, Killylea, Co. Armagh.
31. ST. AUBYNS (BUCKHURST HILL)—F. Mudditt, "Glendower," Grove Road, S. Woodford.
32. DONCASTER PIONEER—W. S. B. Bagshaw, 3, Lawn Avenue, Doncaster.
33. NEWCASTLE (BYKER)—K. Mark, 445, Chillingham Road, Heaton, Newcastle-on-Tyne.
34. DORCHESTER—J. Rogers, 10, High Street, Dorchester, Dorset.
35. LADYBARN (MANCHESTER)—D. Gribbin, St. Chads Rectory, Ladybarn, Manchester.
36. ENGINEERING SOCIETY (HARROGATE)—W. J. Perry, Ashville College, Harrogate.
37. PLYMOUTH (MUTLEY)—K. Wills, 8, Beechwood Avenue, Mutley, Plymouth.
38. SHREWSBURY—Mr. E. Aston Philpott, 4, John Street, Castle Fields, Shrewsbury.

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

ASHINGTON—A. D. Peggs, 17, Park Road East, Ashington, Northumberland.
BARNES, S.W.13—D. J. Higgens, 28, Hillersdon Avenue, Barnes, S.W.13.
BLACKPOOL—R. V. Bentley, 9, Bamton Avenue, Watsons Road, Blackpool.
BURSLEM—J. H. Auty, 50, Park Road, Burslem, S.O.T.
BURTON-ON-TRENT—L. C. Adey, 239, Occupation Road, Woodville, Burton-on-Trent.
BRIGHTON—C. S. Wedlock, 250, Freshfield Road, Brighton, Sussex.
CHESTERFIELD—S. Wheatcroft, 50, Walton Road, Chesterfield.
CANTERBURY—N. Johnson, "Kincraig," Puckle Lane, Canterbury.
CHURCH STRETTON—L. Phillips, "Marshbrook," Church Stretton, Shropshire.
DISS—W. J. Hunt, 38, Mount Pleasant, Diss, Norfolk.
EAST LOTHIAN—C. M. Mackenzie, Belhaven Hill, Dunbar, East Lothian.
EWELL—M. Alvey, "Minora," St. James Avenue, Ewell, Surrey.
GLASGOW—M. S. Higgins, 71, Partickhill Road, Glasgow.
GLASGOW—David Ross, 86, Herniston Road, Shettleston, Glasgow, E.2.
HASTINGS—R. H. Radcliffe, 2, Trinity Street, Hastings.
HUDDERSFIELD—A. F. Roper, 116, Ravensknowle Road, Dalton, Huddersfield.
IRELAND—James Allen, 1, Westend Terrace, Londonderry.
LEEDS—J. N. Smith, 1, Highfield Street, Bramley, Nr. Leeds.
LEICESTER—A. K. Baker, "The Bushes," Caddesby, Leicester.
LEITH—R. Croall, 16, Bangholm Avenue, Trinity, Leith, Edinburgh.
LIVERPOOL—T. E. Pratt, 76, Heathfield Road, Wavertree, Liverpool.
LONDON, N.4—J. Summers, 214, Stapleton Hall Road, Stroud Green, N.4.
MANCHESTER—C. Miller, 75, Withington Road, Whalley Range, Manchester.
MOFFATT—R. McNicol, Holm Park, Warriston, Moffatt.
NORWICH—H. Yallop, 70, St. Clements Hill, Norwich.
PENRITH—J. Horn, "The Pelican," Greystoke, Penrith.
PORT GLASGOW—R. Liddell, "Norwood," 58, Lilybank, Port Glasgow.
READING—R. C. Allison, 7, King Street, Reading.
ROMFORD—C. H. Duranty, 21, Kingston Road, Romford, Essex.
SUNDERLAND—A. Davis, 74, Shrewsbury Crescent, Sunderland, Co. Durham.

OVERSEAS

INDIA—P. C. Manchanda, "Ramour," 2, Mozang Road, Lahore, India.
SOUTH AFRICA—L. Creasey, "Elsinore," Mount Pleasant, Simonstown, S.A.

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

JUNIOR SECTION

V.—Some Hints on Signalling

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

IT appears to be quite a common practice among the younger Hornby Railway enthusiasts to ignore the question of signalling their layouts. It is quite true that no lives are at stake in the running of a miniature railway, but nevertheless an unsignalled layout is always lacking in realism, both in appearance and in operation.

The signalling systems in use to-day on real railways are exceedingly complicated, but fortunately the main principles involved are comparatively simple. The lower quadrant semaphore signal is familiar to everybody. It consists essentially of a post on which is fitted an arm that in the normal position is held at right-angles to the post, but also may be inclined downward. When the arm is in the horizontal position it indicates "danger"; when it is inclined downward to an angle of about 60° it indicates "line clear." The face of the signal arm, that is the side that faces the driver of an oncoming train, is painted red with a white stripe, and the reverse side is white with a black stripe shaped like the front white stripe.

Some of the locomotives and rolling stock of the Ellesmere Branch of the H.R.C. The equipment includes a good assortment of passenger and goods vehicles with which a number of interesting train formations can be made up

Each signal post is fitted also with a lamp that is kept burning continuously and requires replenishing with oil only about once a week. Coloured glasses known as "spectacles" are attached to the signal arms, and through these the driver views the light at night. When the arm is in the horizontal position a red glass covers the light, and when the arm moves to the "all clear" position a blue glass replaces the red one and, in conjunction with the normal yellow light of the lamp, produces a green light. The signals that the driver of a train must look out for are those that point to his left; signals that point to the right can only concern drivers travelling in the opposite direction.

Main Types of Signals

There are two main types of signal arm—those with square ends and those with "fish-tailed" ends. The square-ended type is always a "stop" signal, whereas the "fish-tailed" type is used for warning or cautionary purposes.

The first signal seen by the driver of a train approaching a signal-box is the fish-tailed "distant" signal, so called because it is the signal at the farthest distance from the box. The object of the "distant" signal is to warn the driver when the next or "home" signal is likely to be at "danger," and so give him time to reduce the speed of his train ready to stop at the "home" signal if necessary. As the train is likely to be travelling at a high speed when the driver first sees the "distant" signal, it is clearly necessary that this signal should be sufficiently far in advance of the "home" signal to allow the driver time to pull up at the latter. The standard distances from "distant" to "home" vary from 600 yds. on a rising gradient to 1,000 yds. on a falling gradient. As long as the "home" signal is at danger the "distant" signal also is kept at danger, and the driver slows down and proceeds cautiously towards the "home" signal. If the latter is at danger when he reaches it, he must stop dead and on no account go on until the signal is lowered to the "all clear" position.

The third signal to be reached is the "starting" signal, the function of which is to prevent a train that has passed the "home" signal from starting away until the line ahead is known to be clear. Sometimes there is a crossover road or a siding connection ahead of the "starting" signal. In such cases a fourth signal is necessary, and this is known as an "advanced-starting" signal. Both these signals have square ends like the "home" signal.

How the Block System is Worked

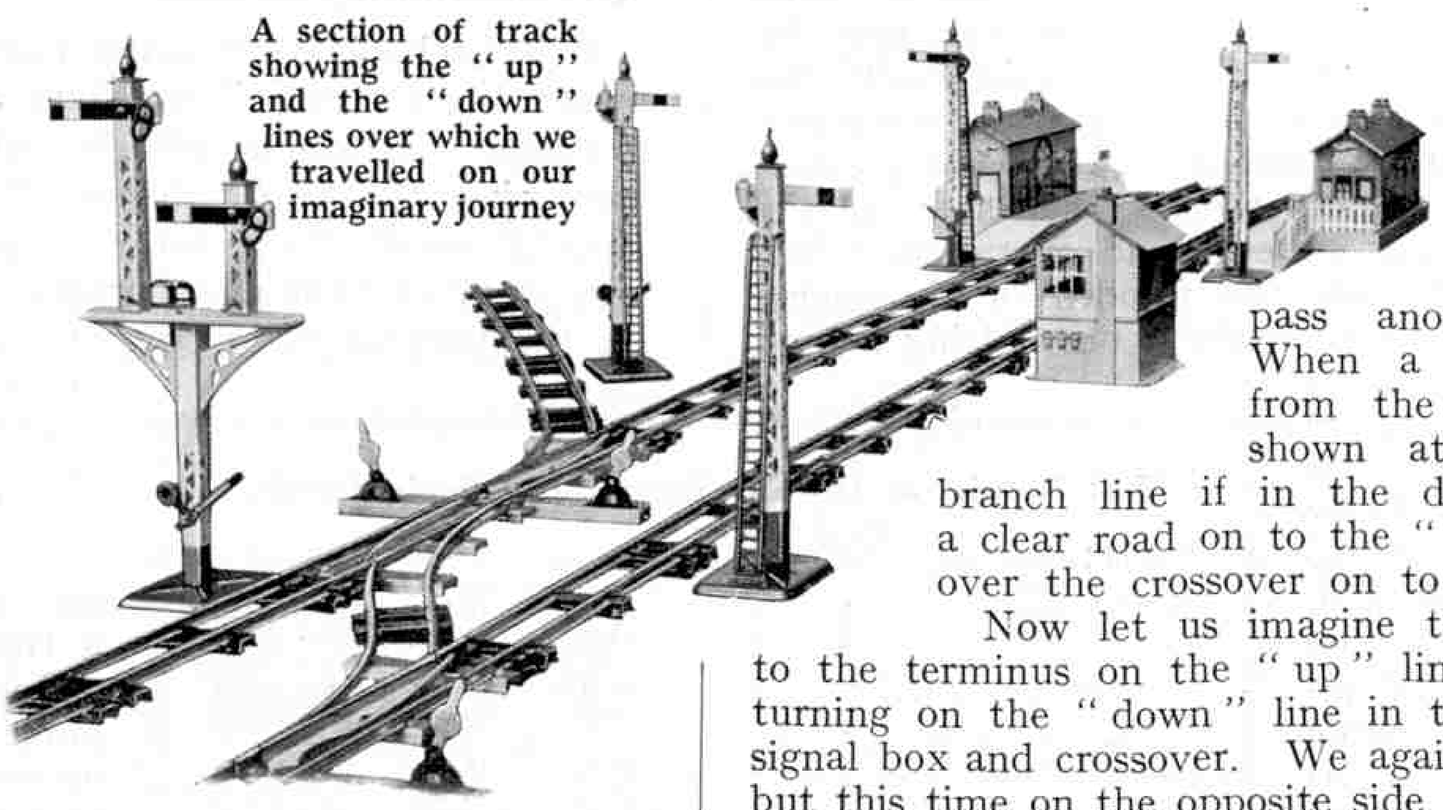
Every signal box is electrically connected with the box on each side of it, and is provided with telegraph and bell instruments. Trains are worked on what is called the "block system." The length of the line between the last stop signal of one box—that is the "starting" or the "advanced starting" signal—and the first stop signal of the next box—that is the "home" signal—is called a "block section," and only one train at a time is allowed to be on each section.

Every signal box has a tapper bell for each section on each side of it, both for "up" and "down" lines, and the communications between signalmen are chiefly made by means of a code of bell signals.

Let us suppose a train is at a certain signal box, which we will call No. 1, ready to commence its journey. The signalman in this box calls the attention of the signalman in No. 2 box by signalling one beat on the bell in the latter's box, and the man in No. 2 box acknowledges this signal by repeating it so that one beat sounds on the bell in No. 1 box. Signalman No. 1 then gives four consecutive beats on the bell in No. 2 box, which in the railway code means "Is line clear for an express passenger train?" The signalman in No. 2 box, after making certain that the line is clear for a quarter of a mile inside his "home" signal, that is, as far as his "clearing point," repeats the four beats, thus indicating "line clear" to the man in No. 1 box.

At the same time signalman No. 2 brings into use his key-disc instrument. This is a box-shaped apparatus having three positions—"line clear," "line blocked," that is the normal position and "train on line." In this case signalman No. 2 pegs his instrument to show "line clear" and so causes the "line clear" indication to appear on a similar but keyless instrument in box No. 1. This gives signal No. 1 permission to send forward the train and he lowers his "starting" signal, and his "advanced starting" signal if there is one, and the train moves forward into the next section. Immediately after lowering his signals the man in No. 1 box gives two beats on the bell signifying "Train entering section," which signalman No. 2 acknowledges by repeating it and at the same time altering his key-disc instrument, and consequently the keyless instrument in box No. 1, to "Train on line." As soon as the train has passed the No. 1 box the No. 1 signals are restored to the normal "danger" position.

The signalman in box No. 2 does not wait for the train to arrive, but immediately calls the attention of the signalman in box No. 3 by giving one beat on the bell, and the process just described is repeated. In this way the train is passed along to box No. 3, and so on from one to another throughout its journey.



A section of track showing the "up" and the "down" lines over which we travelled on our imaginary journey

The Signalling of Model Railways

The signalling of model railways should follow the principles on which real railways are signalled, but on a greatly simplified scale. Generally speaking the fewer the signals used the better, unless the layout is on a very elaborate scale. In a very small layout it is advisable to dispense altogether with "distant" signals, using only "home" and "starting" signals.

The accompanying illustration shows part of a simple layout consisting of a section of double track with a branch line connection. The branch line to the left leads on to a small village station, and the main line passes beyond the station shown to a terminal station. The village station and the terminal station are omitted.

An Imaginary Footplate Trip

Let us imagine that we have the rare privilege of travelling with the driver and fireman on the footplate of a locomotive over this section of track. Commencing our journey on the "up" line we travel towards the "home" junction signal, shown on the extreme left of the illustration. Our driver now looks out to see the position of the signal. If the inner signal arm is down we have a clear road to the signal at the entrance to the station which, when in the "all clear" position allows us to enter the station. On the other hand if the outer and higher junction signal arm is down it would give us a clear run to the next "home" signal on the branch line. The traffic on this line is small and therefore only a single line is required with a loop line (not shown) a little further on to enable one train to pass another if necessary. When a train is returning from the village the signal shown at the left of the branch line if in the down position gives a clear road on to the "up" main line and over the crossover on to the "down" line.

Now let us imagine that we have come to the terminus on the "up" line and are now returning on the "down" line in the direction of the signal box and crossover. We again enter the station, but this time on the opposite side from that on which we travelled previously. This time we find that the "starting" signal is against us. After a few minutes, however, it is lowered and we are enabled to start off once more. As soon as we have passed the signal cabin on our left we come to the "home" signal that guards the crossover, and if this shows "all clear" we may proceed on our journey.

As we have already indicated, the signalling of a model railway layout should be kept as simple as possible. Each signal employed should serve the definite purpose of protecting some portion of the line. To be of any use in a layout, signals must be operated in conjunction with the points, and if the system becomes too complicated it is a very difficult matter to carry out the necessary movements in the short periods that are available. Of course, the more operators there are the more signals can be controlled with success, but over-elaboration is not advisable in any circumstances.

In the majority of cases it is useless for the model railway enthusiast to attempt to reproduce the interlocking arrangements that are so important a feature on real railways. Interlocking may be defined as arranging the operation of the levers in the signal-box in such a manner that they permit one another's movements in carrying out correct setting of points and signals, but obstruct one another so as to prevent wrong setting. Interlocking was introduced for the sole purpose of preventing loss of life through slips on the part of signalmen. Miniature interlocking apparatus is necessarily very complicated, and it cannot be regarded as in any way essential to model railway working.

VII.—SCALE SPEEDS AND OTHER MATTERS

PRACTICALLY all the features that go to make up the fascination of a real railway may be reproduced in miniature, and herein really lies the peculiar attraction of model railways as compared with every other form of hobby. It is the greatest fun in the world to work out on a small scale all the wide variety of railway material and operations. The satisfaction obtained from the wooden or tin engine of one's earliest days, trailed about on a string behind its tireless owner, gives place as years go by to the desire for a train that "goes by itself." Later still the crude and cheap little working model with which the miniature line was first started is abandoned in favour of the scale model, correct as far as possible in every external detail.

Certain features of real railways cannot be treated on exact scale lines. For instance, anything approaching a scale length of track is out of the question. If two stations on a real railway are one mile apart, they would have to be over 100 ft. apart when they were represented correctly on a "0" gauge model! If this were done the great length between the stations would make operation of the model railway either impossible or at least very uninteresting indeed.

We have recently received many inquiries from H.R.C. enthusiasts regarding scale speeds. These correspondents wish to know how the speeds of their engines compare relatively with those of their prototypes. In other words, if a Hornby engine travels, say 45 ft. in 30 seconds, they want to know how many miles per hour this actually represents. In order to provide this information the experts of the Hornby Railway Company carried out a long series of experiments with the different types of Hornby locomotives, and the results of these trials are summarised in the panel on this page. These results are interesting from many points of view, and we shall be glad to have any comments upon them from readers who make similar experiments with their own locomotives.

Test Results of Hornby Locomotive Scale Speeds

Type of Locomotive	No. of Test	No. of Coaches	Distance	Time	Speed
No. 1 Locomotive	1	0	45 ft.	12 sec.	124.3 m.p.h.
	2	3	45 ft.	29 sec.	50.6 m.p.h.
No. 1 Tank Locomotive	1	0	45 ft.	13.5 sec.	108.9 m.p.h.
	2	3	45 ft.	29 sec.	50.6 m.p.h.
No. 2 Locomotive	1	0	45 ft.	15 sec.	98.6 m.p.h.
	2	4	45 ft.	27 sec.	54.5 m.p.h.
	3	6	44 ft. 6 in.	45.5 sec.	32.3 m.p.h.
No. 2 Tank Locomotive	1	0	45 ft.	16 sec.	92 m.p.h.
	2	4	45 ft.	24 sec.	61.4 m.p.h.
	3	6	45 ft.	43.5 sec.	33.9 m.p.h.
No. 3 Locomotive	1	0	45 ft.	11 sec.	133.5 m.p.h.
	2	4	45 ft.	23 sec.	64.3 m.p.h.
	3	6	45 ft.	33 sec.	44.8 m.p.h.
	4	8	45 ft.	44 sec.	33.6 m.p.h.
	5	8	45 ft.	30 sec.	49 m.p.h.
	6	9	45 ft.	33 sec.	44.8 m.p.h.
	7	10	45 ft.	54 sec.	27.25 m.p.h.

Weight of Locomotives and Tenders

No. 1 Locomotive... ...	21 oz.	No. 2 Tank Locomotive ...	34 oz.
No. 1 ,, and Tender	24 ,,	No. 3 Locomotive ...	30 ,,
No. 1 Tank Locomotive ...	21 ,,	No. 3 Locomotive and Tender	35 ,,
No. 2 Locomotive... ...	29 ,,	No. 2-3 Pullman Coach ...	21 ,,
No. 2 ,, and Tender	33 ,,		

Meccano-Hornby Layouts

It is probable that many boys who are the happy owners of Hornby Train Sets are also Meccano enthusiasts, and these will be interested no doubt in combining the two hobbies. The fun of running a Hornby goods train, for example, may be increased very greatly by the use of cranes constructed in Meccano for the purpose of loading and unloading the wagons. Several simple types of cranes may be set to work in this manner by the exercise of a little ingenuity.

A particularly interesting combination consists of a Hornby goods train and a Telpher Span. The Telpher Span may be connected up across the room and made to convey miniature loads from, say, an imaginary quarry to a goods siding, ready to be deposited into the wagons by means of a suitable crane.

This operation may be made a great success if two or more boys are working together. The material may be brought from the quarry, loaded into the wagons and then the train dispatched to its destination. There the wagons may be unloaded at once, or they may be shunted into a siding and another train of empty trucks made up. In the meantime the Telpher Span is at work bringing fresh material for a second load. With a little experiment in timing the various operations the process may be developed on quite realistic lines.

As regards the loads for the wagons, the miniature Meccano Sacks (part No. 122) may be used, and in addition, an almost infinite variety of loads of different kinds may be improvised from materials to be found in every house. For instance, empty cotton reels may be used to represent casks and barrels, and beads or dried peas make excellent material for tipping wagons.

A goods warehouse is a further very useful addition to any model railway and this again could be constructed in Meccano. For this purpose, Model No. 4.40 in the Meccano Manual could be used, although boys who have larger outfits would find Model No. 7.30

more interesting. This latter model contains two electrically operated lifts which are worked from a Meccano Electric Motor. The inclusion of this warehouse in any model layout would be a very useful addition.

Where a very extensive layout is available there could be nothing more interesting than a replica of the Forth Bridge, a model of which is also included in the Meccano Manual. The spectacle of Hornby trains running over this bridge will never fail to attract a great deal of interest and attention. From these few suggestions it will be seen that there is indeed no limit to the capabilities of Meccano used in conjunction with a Hornby Train Layout.

The Excitement of Long Runs

As a change from operating a more or less elaborate layout with branch lines and sidings, it is a good idea occasionally to lay down a track to provide as long a run as the engines can manage on one winding. It frequently happens that, owing to the limited floor space available in a small room, particularly one that contains a good deal of furniture, a satisfactory layout of this nature is difficult to arrange. In many quite small houses, however, there is often a fairly long hall or landing that can be pressed into service, thus making possible a much longer run than could be obtained in any one of the rooms alone.

The "up" express leaving Penrith, hauled by L.M.S. "Royal Scot" type 4–6–0, No. 6113, "*Cameronian*." This is the locomotive that performed the record non-stop run on the "*Royal Scot*" train between London and Glasgow in April 1928

In the case of a landing it is sometimes possible for the layout to be extended so as to pass into and around a bedroom, and it is quite exciting to watch the trains disappear into the room and come into view again in businesslike fashion shortly afterwards! The use of a room in this manner makes the return of the trains to their starting point quite a simple matter, so that if necessary a single operator can carry on quite well. Of course, much more interest and excitement is to be had when two or three operators are available.

The Question of Outdoor Layouts

At this time of the year, especially if the weather is good, we begin to receive many inquiries as to whether it is possible to lay down a Hornby track out of doors. In really dry weather there is no reason why a Hornby railway should not be taken out into the open air, if a small level piece of close-cropped grass is available, or failing that, a level stretch of path. Unless the conditions are particularly favourable, however, it may be found necessary to provide at certain points a foundation of planks of some kind in order that the track may be sufficiently firm to allow of safe running.

If a room with French windows opening on to a lawn is available, a combined indoor and outdoor line may be arranged, the terminal stations being inside the room and the track passing through the open windows on to the line, sweeping round in a circle and finally returning to the room again. A big layout of this kind worked by two or three operators is quite an exciting affair.

In any case, the main thing to remember is that the Hornby track is manufactured specially for indoor use, and will become rusty very quickly if left out in the rain or heavy dew. Some H.R.C. members have suggested painting their track with some kind of oil preparation to prevent rust. This is possible, but to do it thoroughly would be a very troublesome business, and certainly would not improve the appearance of the track when it was brought indoors once more. The safest and most satisfactory plan is to have the railway out of doors only when the ground is perfectly dry, and never in any circumstances to leave it out all night.

The Classification of Locomotives

Many of the younger H.R.C. members appear to have a little difficulty in understanding exactly how loocmotives are classified according to the number and arrangement of their wheels.

The modern method of representing the classification by a system of numbers is really very easy to understand. For this method the normal arrangement of wheels in every locomotive is assumed to be—first, leading wheels; second, coupled driving wheels; and third, trailing wheels. The wheels of tenders are left out of consideration. For example, a locomotive having four leading wheels, four coupled driving wheels, and two trailing wheels, would be described as being of 4–4–2 type, the figures indicating quite clearly the wheel arrangement. If a locomotive has either no leading wheels, or no trailing wheels, a cipher, "0," is used instead of a figure to indicate the absence of either or both of these sets of wheels. Stephenson's famous "*Rocket*," the winner of the Rainhill contest, was an 0–2–2 locomotive, being without leading wheels and having only two driving and two trailing wheels.

It should be noted that in France and certain other Continental countries the number of axles is counted instead of the number of wheels, so that the figures are halved. Thus, a locomotive that we should describe as being of 4–4–2 type, would be described in France as 2–2–1. It is necessary to distinguish tank locomotives from those that have tenders. It is customary to do this by placing the letter "T" after the figures denoting the wheel arrangement; for example, 4–4–0 T.

A Model Railway with Unusual Features

Mr. M. B. Flanders' G.E.R. Reproduction

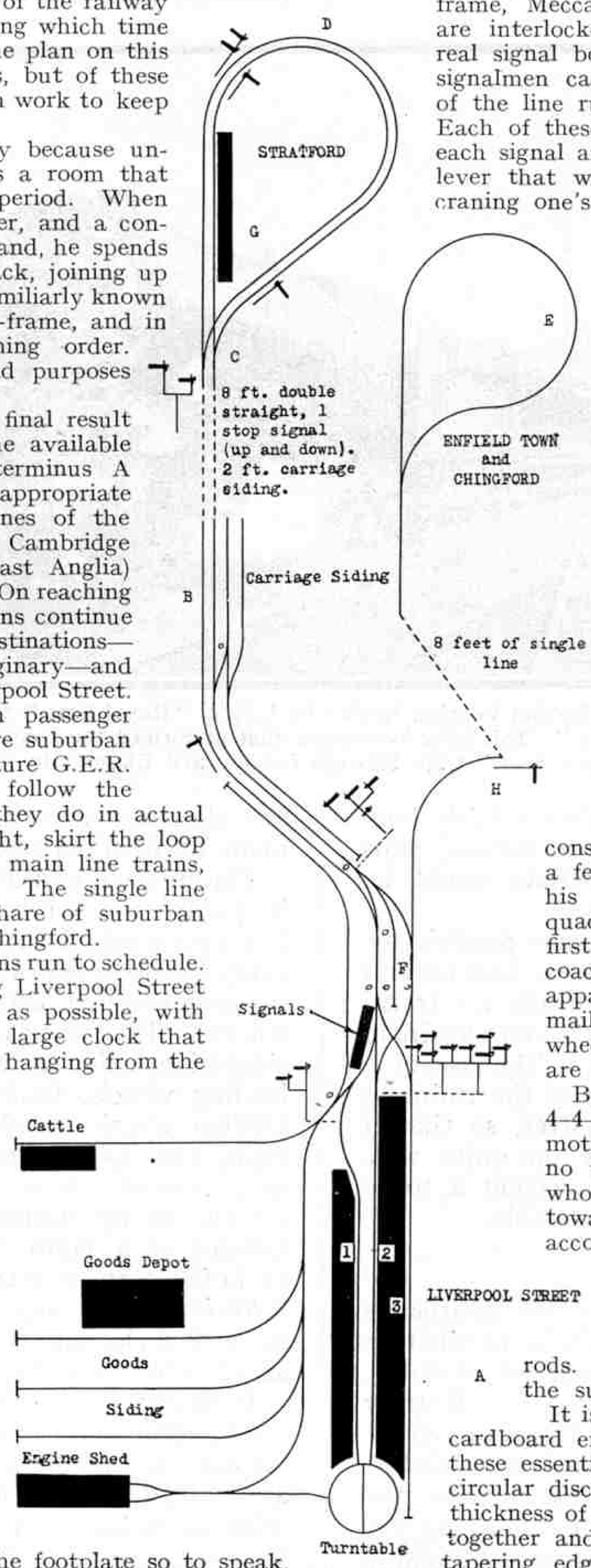
THIS model railway system contains many interesting and unusual features but at the same time is yet far from complete in certain essentials. Nearly all the accessories are home-made, and as the owner's spare time is limited, and the process of building is slow, the development of the railway cannot be rapid. As a matter of fact, the layout of the railway has been in existence for five years during which time it has been added to bit by bit. As the plan on this page shows, there are only two stations, but of these the terminus alone provides quite enough work to keep three operators extremely busy.

The line is not laid out permanently because unfortunately the owner does not possess a room that can be made available for an indefinite period. When a favourable opportunity occurs however, and a considerable amount of spare time is at hand, he spends two or three days in laying out the track, joining up all points, signals and ground signals—familiarly known as "Tommy Dodds"—to the ground-frame, and in general getting everything into running order. The railway is then to all intents and purposes permanent for the time being.

The plan reproduced here shows the final result of prolonged experiment in utilising the available space to the best advantage. The terminus A is called Liverpool Street, however inappropriate the name may be. The two main lines of the G.E. Section of the L.N.E.R. (one to Cambridge and Ely, the other to Ipswich and East Anglia) are here united into one set of metals B. On reaching Stratford, the junction C, main line trains continue along the straight track to their destinations—which, by the way, are quite imaginary—and return, by means of the loop D, to Liverpool Street. The G.E.R. has an enormous suburban passenger traffic with which to deal, and therefore suburban traffic is very extensive on this miniature G.E.R. Epping and Ongar suburban trains follow the main line to Stratford C, as indeed they do in actual practice. They then branch to the right, skirt the loop D, though in the opposite direction to main line trains, and return again to Liverpool Street. The single line branch E is supposed to carry a large share of suburban traffic to and from Enfield Town and Chingford.

Not only passenger, but even goods trains run to schedule. A departure timetable for trains leaving Liverpool Street is in force, and corresponds, as nearly as possible, with that actually used by the G.E.R. A large clock that shows the flight of seconds is to be seen hanging from the station buildings, and it is by this that trains are timed. Main line expresses are due at the terminus 60 seconds after they have left it, though suburban trains on the Epping and Ongar branch take 75 seconds to do their journey. Stopping trains take 10 seconds longer, while trains to Chingford or Enfield (on the branch E) may be seen arriving at the terminus 45 seconds after their departure times, if nothing untoward occurs on the journey.

This arrangement makes the working of the line very interesting, and this is why. With the exception of a Hornby Zulu tank locomotive and a Caledonian 4–4–0, none of the engines in use has any motive power, for it seems to the owner more realistic to be in personal charge of the train on the footplate so to speak, by taking the engine round the track with a hand on the cab or the tender, and thus being in a position to observe and obey the signals. This idea will, of course, not appeal to every model railway enthusiast, but it is certainly worth consideration.



With the exception of the double junction at C the track consists entirely of Hornby rails. All points on the main line are worked by the Hornby Control System, both points in any crossover being joined to one lever, of course; and, together with every signal and "Tommy Dodd" on the line, are manipulated from a ground-frame, Meccano-constructed, containing 40 levers which are interlocked to a considerable extent. As in many real signal boxes that control large junctions, where the signalmen cannot see the complete junction, a diagram of the line runs down the box above the row of levers. Each of these levers has a number, and on the diagram each signal and switch is indicated by the number of the lever that works it. This method saves the trouble of craning one's neck round the intervening portion of wall to see the state of the trains out on the main line. The cabin itself is constructed of strong cardboard, painted to represent red brick, and varnished, and is made to open in the rear to provide easier access to the levers, as in the case of the No. 2 Hornby Signal Cabin.

The owner made a small beginning on model railways five years ago, when he acquired a Hornby Zulu tank engine and three open wagons. He made additions to the goods rolling stock at various times in the shape of Hornby brake vans, oil tanks, open wagons and covered vans, and after two years or so, he bought a complete Pullman Car set.

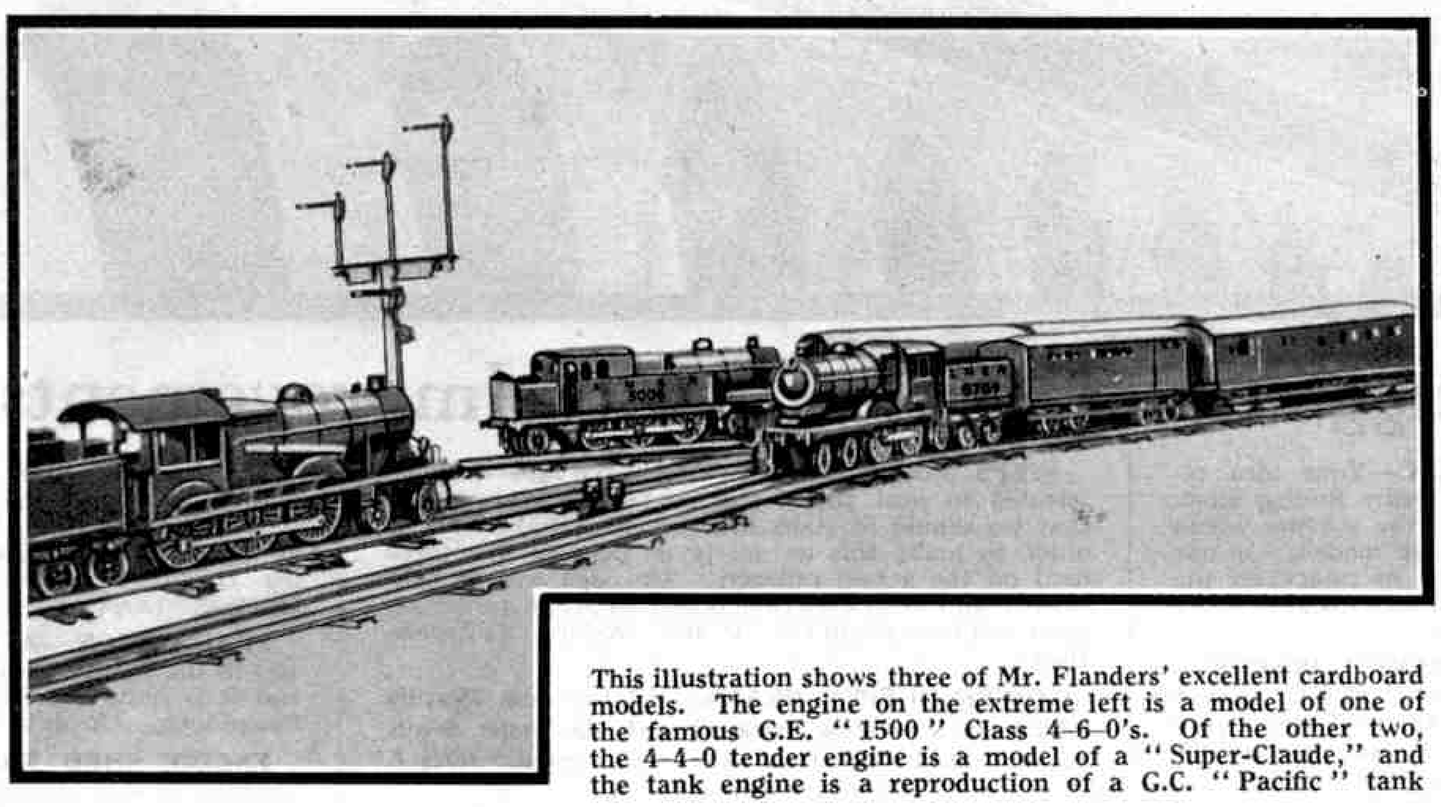
It was just about this time that he first conceived the idea of building his own models by means of cardboard and Seccotine. At first he attempted only stationary models, such as a large engine shed to hold two express engines; a 19 in. diameter turntable on which to turn them; a goods depot; a cattle pen, and various platelayers' and fogmen's huts. He soon started to construct rolling stock, however, and after making a few open wagons and covered wagons turned his attention to coaching stock. A complete quadruple articulated suburban train appeared first, followed by five various main line corridor coaches, and a six-wheeled mail van fitted with apparatus for picking up and setting down the mails at speed. It should be mentioned that all wheels other than those on the engines themselves are Hornby tinplate coach wheels.

By this time, of course, a Zulu tank and a 4–4–0 tender engine provided very inadequate motive power for the wants of the line. Having no wish to go to the expense of refitting the whole line electrically, and not being attracted towards model steam locomotives and their accompanying mess, the owner set himself the task of building, almost entirely of cardboard and paper, engines that would run up and down tinplate rails on properly revolving wheels with workable coupling rods. The accompanying photographs demonstrate the success of the scheme.

It is a comparatively simple matter to construct cardboard engines, once the wheels are finished, though these essential parts require a great deal of care. Two circular discs of exactly similar dimensions, and with a thickness of roughly one-tenth of an inch each, are glued together and to a slightly larger but thinner disc with tapering edge that forms the flange. The flange and tread of the resultant wheel are then carefully covered with Seccotine, which dries perfectly hard and smooth, making an excellent surface for a wheel. Axles are nails of exactly the right length driven through the centre of the wheel and firmly

glued in place. Coupling rods are treated with Seccotine in the same manner as the wheels, on which they are pivoted by means of strong pins. They have a very realistic appearance.

Let us imagine that by some means we have been transformed into tiny human beings about one-and-a-half inches in height, and that we are about to travel to Harwich on this miniature line's "*Hook Continental*," and back again, of course! If we arrive at Liverpool Street at somewhere about ten minutes thirty-five seconds past eight in the evening—for the 8.30 "*Hook Continental*" leaves at 8.15 p.m. now—we shall probably find our train drawn up in No. 3 platform. First of all, against the buffers, we shall find a third-class brake composite coach; attached to it an all-third corridor; then a third-class restaurant car, a kitchen and first-class restaurant composite coach, a first-class Hornby Pullman and, last of all, an all first-class corridor. Our engine, one of the famous G.E. "1500" class, is just leaving the turntable and, after running through platform 2, draws out into the open, reverses, and then backs on to the train. We will take our seats in the front first-class compartment, where we can watch the extensive suburban traffic until we start out.



This illustration shows three of Mr. Flanders' excellent cardboard models. The engine on the extreme left is a model of one of the famous G.E. "1500" Class 4–6–0's. Of the other two, the 4–4–0 tender engine is a model of a "Super-Claude," and the tank engine is a reproduction of a G.C. "Pacific" tank

With a loud thudding of wheels on points and rail joints, the 8.12 p.m. to Chingford, having slightly cut its time allowance of 45 seconds, rushes into platform 2 at 8.12.42. Out it goes again at 8.14, this time to Ongar, and drawn by a G.C.R. 4–6–2 tank, which has been waiting in the dock siding F. It disappears in the distance, our signal on the eight-arm gantry at the end of the platform drops, and with a shrill whistle we begin to move, very slowly at first, but gradually gaining speed over the points and round the sharp curves near the station. As there is no incline at 1 in 70 out of this Liverpool Street, and no slowing necessary on the down journey at this Stratford, we gain two distinct advantages over our life-size contemporary. Very soon we are speeding through Stratford—where we shall probably notice our friend the Ongar train just about to leave on her return journey—but immediately outside it the brakes go on hard in order safely to take us round the sharp curve.

And now you must imagine an hour or so's run through the country side, the passage of several junctions, the arrival at Harwich, the Customs, the crossing the North Sea, your holiday or whatever engagement you meditated, your return—in short, you must imagine yourself back in that first-class compartment and approaching Stratford on the up journey, slowly this time, because of the sharp curve. Probably we shall see, waiting in the station G, an Epping suburban train, whose engine is snorting impatiently at the starting signal, while we glide over the double junction in front of it.

Swift acceleration on the straight stretch past the carriage sidings, which you will see are quite long, with one stop signal in each direction to govern them, brings up our speed to exactly 60 m.p.h. before the final check, which is necessary to take us safely over the points into the terminus. Very probably one of those inevitable suburban trains from Chingford will accompany us into the station, and draw up with a little jolt in platform 3, while we slowly and majestically come to rest in platform 2, our engine running straight on to the turntable before stopping in order that our long train shall clear the points outside.

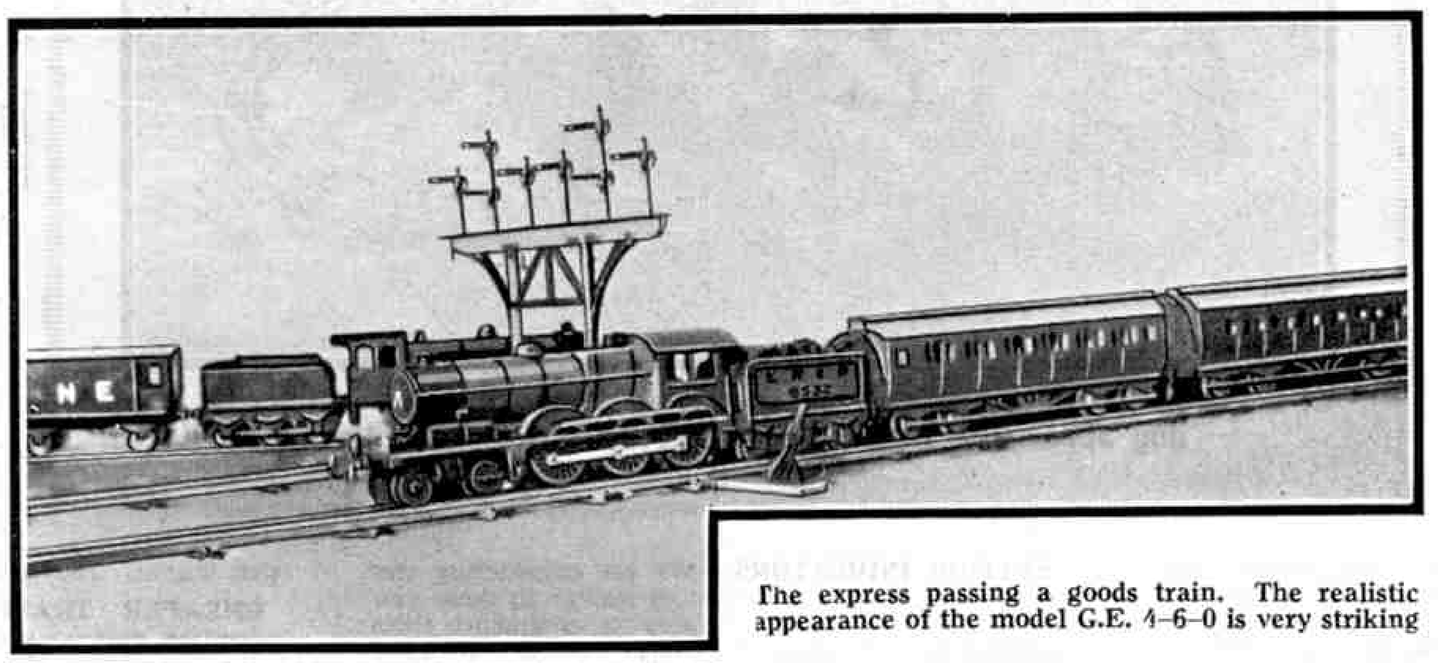
Let us get out and pay a visit to the goods siding. Goods traffic, at its heaviest during the slack hours of the afternoon, is worked in the following manner. A 0–6–0 shunting tank engine makes up a train of loaded trucks, each labelled for its destination, and, after a brake-van has been attached to the rear, the complete goods train is handed over to a large 0–6–0 tender engine of the G.E. "1200" class, which draws it once round the main line and into the siding again. The goods train is then supposed to have reached its first destination. The trucks for this station are detached, the brake-van is shunted again to the rear, and off goes the slightly shortened train once more. This process is repeated until the train is reduced to "nothingness." On the whole, this scheme provides fairly realistic working.

The following is a list of the rolling stock, all home-made except the Hornby vehicles:—Locomotives:—L. N. E. R. (G. E. Section) 4–6–0 No. 8532; 4–4–0 No. 8789; 0–6–0 No. 8212; and 0–6–0 Tank No. 7344; (G.C. Section) 4–6–2 Tank No. 5006. L.M.S.R. (Caledonian Section) 4–4–0 Hornby No. 2710. S.R. (L.S.W.R.) 0–4–4 Tank No. E.59. Zulu Tank Locomotive.

Rolling Stock:—L.N.E.R. (G.E. Section) quadruple articulated suburban train set; five various main line corridor coaches; six-wheeled mail van; horse box, L.M.S.R. (Caledonian); two Hornby Pullman coaches.

Various goods wagons, open and closed, including coal trucks, cattle trucks, luggage vans, milk vans, oil tanks, lumber wagons, brake vans, and a Hornby breakdown crane, amount in all to a total of some forty vehicles.

Plans are already on hand for the construction of a new quintuple articulated suburban train set (L.N.E.R., G.E. Section); one of the new L.N.E.R. 4–6–0 three-cylinder express engines of the "Sandringham" class for use on the G.E. Section; and one of the now well-known L.N.E.R. 0–6–2 tanks for short-distance passenger train running.



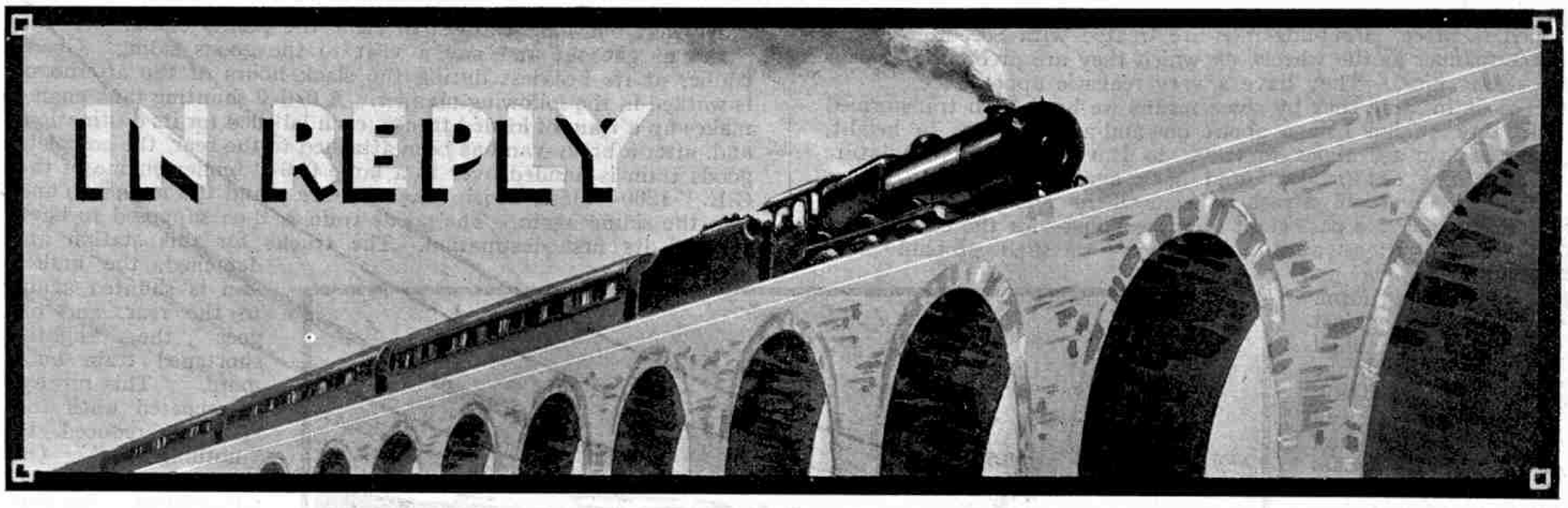
The express passing a goods train. The realistic appearance of the model G.E. 4–6–0 is very striking

The following points may be interesting. All signals and "Tommy Dodds" are made of cardboard, with wire to connect movable parts. Even bell-cranks, of which there is a very large number, are cut from cardboard and coated with Seccotine to stiffen, with the exception of those for points, which are provided by Meccano bell-cranks. Spindles for signal arms and bell-cranks are afforded by strong pins, and weights for levers are made of pieces of sheet lead. Levers are connected to the ground-frame by strong white thread.

The entrance to Liverpool Street from the branch E is guarded by a route indicating signal H. The arm of this signal is connected to three numbers, 1, 2 and 3, each of which is weighted and connected to a separate lever in the ground-frame. (No. 1, of course, is not joined up for use in this plan).

The six-wheeled mail van, mentioned previously, is fitted with sliding doors which, when open, allow the receiving net to be fixed. A standard is fastened to the floor by the rail side near Stratford, from which is suspended a miniature mail bag; and this latter is very realistically "gathered" by the receiving net. In much the same manner mails are dropped at the same time.

All home-made vehicles are weighted (*Continued on page 425*)



Suggested Hornby Train Improvements

BRAKES ON ROLLING STOCK.—Your idea regarding the fitting of brakes to Hornby Rolling Stock is interesting, but we are afraid the scheme would be impracticable in the case of small models. In our opinion, miniature brakes are not necessary on the average type of gauge "0" rolling stock. (*Reply to C. Aldridge, Victoria, Australia*).

"HORNBY RAILWAY COMPANY" WAGON.—A standard Hornby wagon lettered "H.R.C." would no doubt be very popular. We shall give the idea very careful consideration as soon as an opportunity arises. (*Reply to Mac Widdup, Barnoldswick*).

MODEL WATER TROUGHS.—We have received several suggestions for the introduction of a special type of rail fitted with a miniature water trough. We do not think that such a rail is suitable for gauge "0" railways. The slightest accident on the line would cause the water in the trough to spill, and damage of some kind would be certain to result. (*Reply to K. Marchant, Bath*).

GLASS-LINED MILK TANK WAGON.—The demand for a glass-lined milk tank wagon continues to increase, and we are glad to be able to announce that we have definitely decided to introduce a wagon of this type. Full details will be announced as soon as the wagon is available. (*Reply to B. D. Burrows, Bexhill-on-Sea, and many others*).

SOUTHERN ELECTRIC TRAIN.—Your suggestion for a model of a Southern electric train is interesting and it will be filed for future consideration. (*Reply to P. Kidd, Bexhill-on-Sea*).

COVERED-IN FOOTBRIDGE.—We agree that a model of a covered-in footbridge would be very popular with Hornby Train enthusiasts. We are not able to do anything in the matter at present, but the idea will be borne in mind when next we consider additions to our Hornby accessories. (*Reply to K. W. Grimsley, Birmingham*).

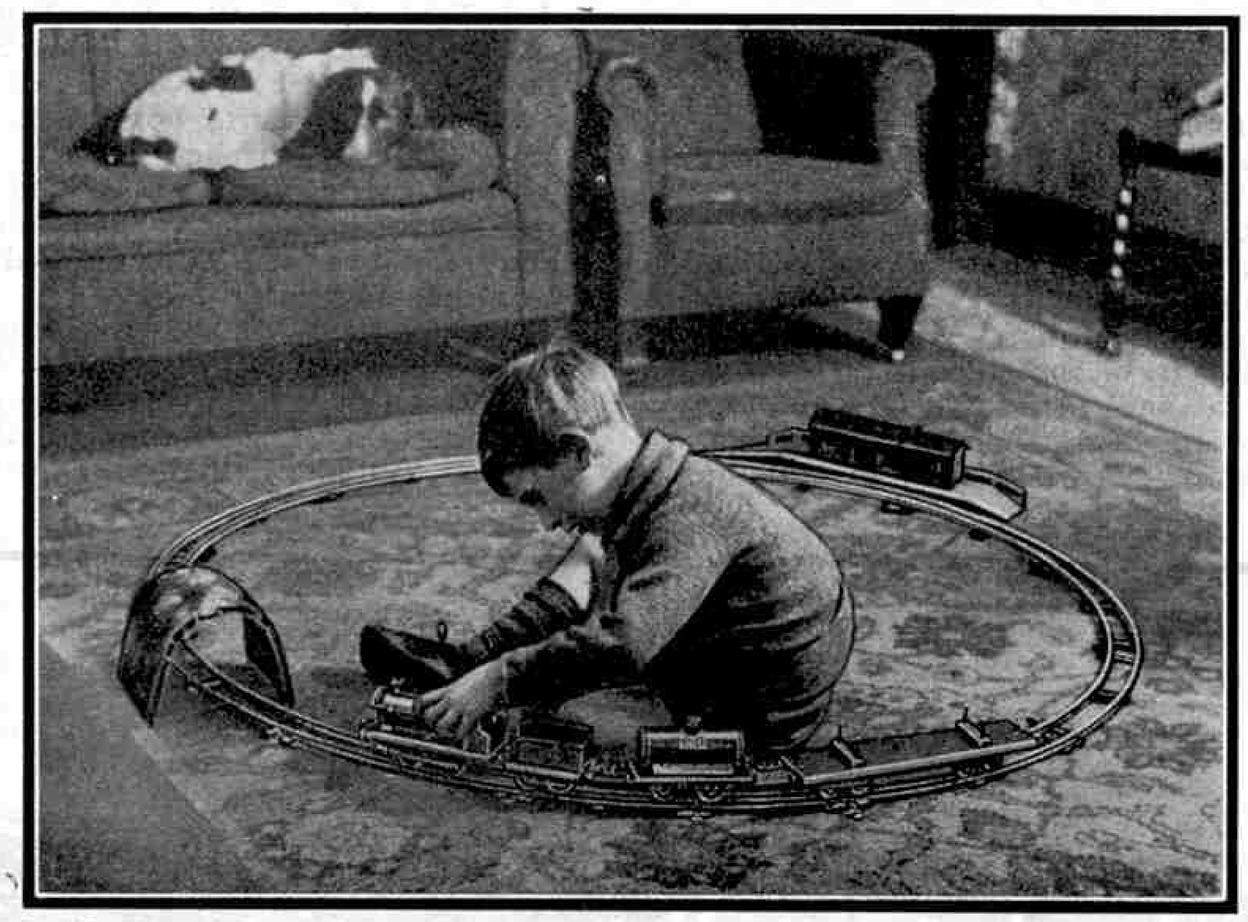
AUTOMATIC SIGNALS.—Your suggestion for special automatic signals to be operated in conjunction with points is very interesting, but we are afraid that the necessary apparatus would be far too costly to prove popular. (*Reply to W. B. McColl, Cathcart*).

CORRIDOR TENDER.—No doubt the No. 3 "*Flying Scotsman*" locomotive would be more realistic if supplied with an 8-wheeled corridor tender. On the other hand, a model of the new type of L.N.E.R. corridor tender would be very expensive to produce. A more serious objection to the idea, however, is that the corridor tenders fitted to the L.N.E.R. "Pacifics" have 8-wheeled *rigid* wheelbases. A model built on these lines would therefore present difficulties on the average gauge "0" layout immediately the curves were reached. (*Reply to Mr. J. L. Bennett, Colgate, Nr. Horsham*).

SHORTER COUPLINGS.—We have already shortened the couplings of Hornby locomotives and rolling stock to what we consider the minimum safe size. Perhaps you have not yet come across any locomotives or rolling stock fitted with the new type of couplings, although these are already on the market. (*Reply to N. I. Ramsay, Canterbury*).

STEPS FOR GUARD'S VAN.—We are very interested to read your letter containing a suggestion that we should fit steps to our model Brake Van, in order to make this as nearly as possible like those used on the actual railways. The idea will be considered, and when a decision is arrived at, an announcement will be made in the "*M.M.*" (*Reply to A. Tucker, Bude*).

LOWER BUFFER BEAMS.—All the new Hornby rolling stock is being designed with the buffer beam an inch in height from the rail running surface. (*Reply to D. Booth, Southampton*).



L. C. Egan of Blackburn, deeply engrossed in his Hornby Railway. The dog appears to be keeping one eye on the proceedings!

STATION INDICATORS.—We are considering the introduction of station indicators similar to those you describe, but we are not able to commence their manufacture at present. (*Reply to R. Wrigley, Cheshire*).

AUTOMATIC STOPPING DEVICE FOR ELECTRIC ENGINES.—We have examined your suggestion for a switch to be fitted to Hornby electric locomotives to enable the current to be switched off from the motors, even though it be turned on at the rheostat. You will be interested to hear that a switch of this type is already fitted to all Hornby electric locomotives. (*Reply to G. E. Murphy, Neville, Canada*).

IRON WHEELS FOR HORNBY TRUCKS.—The introduction of a wheel of this kind was considered some time ago, but on investigation we found that the cost of production would be too great. We have, however, introduced the new Mansell wheels, which may be obtained price 4d. a pair (there are two wheels on one axle). If preferred, heavy spoked wheels as fitted to the Snow Plough can be obtained at a price of 2d. each and axles at 3d. a dozen. (*Reply to Peter Elford, Hornsey, London, N.8*).

NUMBERING OF LOCOMOTIVES.—You are quite right saying that it is actual railway practice to number L.N.E.R., S.R., and G.W.R. locomotives on the front buffer beam, and we will consider numbering Hornby locomotives in accordance with this practice. (*Reply to C. E. J. Hayles, Brighton*).

FISH WAGON.—A fish wagon would, no doubt, add to the completeness of the Hornby Rolling Stock, and it is quite possible that we shall introduce one before long. (*Reply to C. S. Wedlock, Brighton*).

ENGINE SHED FOR ELECTRIC RAILWAY.—A locomotive shed designed for use on electric model railways is undoubtedly an interesting accessory, and we have placed such a shed on our list for consideration. In the meantime we wish to draw your attention to the fact that it is possible to obtain Hornby electrical engine sheds by applying direct to Meccano Ltd. (*Reply to D. Wheeler, Bromsgrove*).

COMBINED TURNTABLE AND RIGHT-ANGLE CROSSING.—This is a very ingenious suggestion, but it would be expensive to make. In addition, we do not think it would be received with such enthusiasm as you imagine, because such an arrangement is very rarely found in actual railway practice. (*Reply to C. Sharples, Chorley, Lancs.*).

BOGIE WAGON.—An eight-wheeled open bogie wagon has many points of interest and probably would prove a popular item. We will consider the introduction of such a wagon, and refer to the matter again on this page. (*Reply to Mr. H. Foster, Coggeshall, Essex*).

SPECIAL "SCREWDRIVER" TRUCK.—Owing to the fact that such a wagon is never used in actual railway practice, we do not consider it would be sufficiently popular to justify our introducing it. When you require to carry screwdrivers, oil cans, etc., "per rail," we suggest that you should use the standard type of Hornby open wagon. (*Reply to R. S. Kinsley, Cardiff*).

CHEAPER TRAIN SETS.—In regard to your suggestion that we should produce cheaper train sets, we are afraid that this cannot be considered. We can assure you that the prices of Hornby goods are kept as low as possible and the only way cheaper sets could be manufactured would be by using poorer materials, with the result that the trains would be much less realistic. This is distinctly against our principles and certainly will not be adopted. The idea of fitting all rolling stock with Mansell wheels is interesting, but it would make the stock too costly. (*Reply to D. Rochel, 38, Knowles Street, N. Zealand*).

SHELL WAGON.—We have carefully considered your suggestion for a new Shell Wagon, but we are afraid that we cannot go further into the matter as we have already introduced four types of petrol wagons. (*Reply to Herbert Rawlings, Toowoomba, Queensland, N.Z.*).

DROPPING SIDES TO OPEN WAGONS.—Your suggestion that we should introduce an open wagon with "let down" sides is very interesting. We are therefore filing your idea for consideration. (*Reply to A. Jones, Cardiff*).

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

AN INTERESTING TRACK-LAYING PROBLEM

During a recent meeting of the "Puddleton" Branch of the Hornby Railway Company, Smith, the Secretary, put forward the suggestion that the existing Hornby Train layout was getting rather stale, and that it would be a good idea if it were revised. The members agreed, and quickly started to submit suggestions. It was unanimously resolved to take advantage of the generous offer of Mr. Williams, who is a signalman at "Puddleton Junction," to give assistance in signalling, so that the layout would be thoroughly railway-like.

After a good deal of consultation and discussion a suitable layout was produced, and Mr. Williams set to work to signal it. This task did not take very long, and in due course he laid his plan before the committee, by whom it was eagerly approved.

At the next Branch meeting it was decided to procure the signals that Mr. Williams had recommended, and on the following day Smith visited the local Hornby Train dealer and made the necessary purchases. He then hurried back with his treasures to the Branch room to prepare the new layout, but to his dismay he was unable to find the plan of the proposed track! Becoming seriously alarmed, he sent out "S.O.S." messages to the members, who promptly responded. High and low they hunted for the plan, but without success. Then somebody suggested that Mr. Williams might remember how the track and signals had been arranged, and Smith rushed off to consult him. Unfortunately Mr. Williams had only a very vague recollection of the track; all he had was a rough sketch showing the position of the various signals.

As may be imagined, Smith was greatly worried over the matter, and finally, as a sort of forlorn hope, he decided to write to H.R.C. Headquarters to see if the staff there could devise a track to suit the arrangement of the signals as shown by Mr. Williams' rough drawing. As soon as his letter was received the staff at H.Q. set to work, and in a very short time they had devised a layout in accordance with the arrangement of the signals. This was duly forwarded to Smith, and thus the situation was saved.

The H.Q. staff found this layout problem so interesting that it was decided to give all H.R.C. members an opportunity of trying to solve it for themselves. Accordingly we illustrate on this page Mr. Williams' plan of the signal arrangement, and H.R.C. members are invited to try to work out the layout of the track for which the signals are arranged.

No attempt should be made to solve the problem on the page itself. The signals should be copied on to a sheet of paper, and the layout worked out bit by bit until the section is complete.

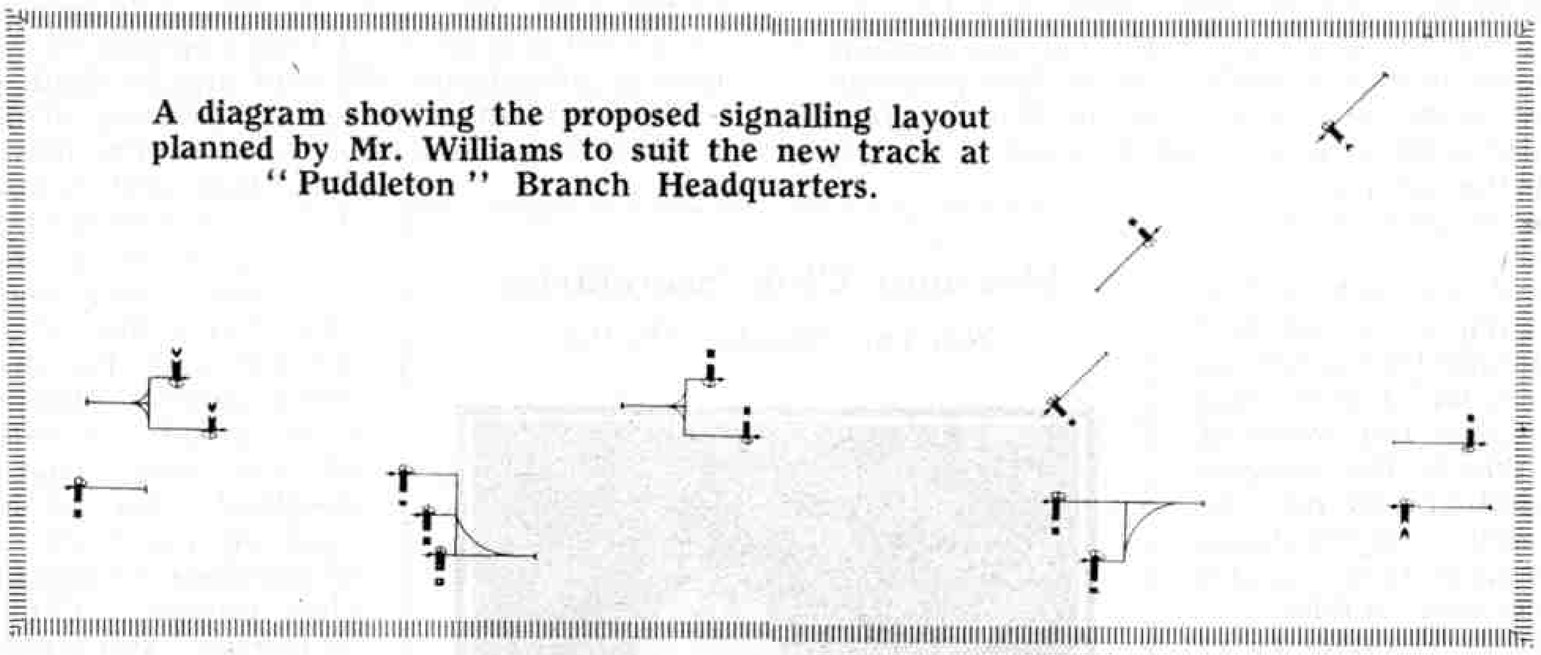
Each entry must bear the competitor's name, address and membership number clearly written, and the envelope in which it is sent to Headquarters should be marked "Track-laying Problem" in the top left-hand corner, using block lettering.

It should be remembered that the omission of the H.R.C. membership number from any entry will cause it to be disqualified immediately.

Prizes of Hornby Railway goods, or Meccano if preferred, to the value of £1-1s., 15/–, 10/6, and 5/- will be awarded respectively to the four competitors who send in the four most neatly prepared and correct plans of a section of track to suit the signal arrangement illustrated.

Entries for the Home Section must reach this office not later than 31st May, and for the Overseas Section not later than 31st August.

A diagram showing the proposed signalling layout planned by Mr. Williams to suit the new track at "Puddleton" Branch Headquarters.



Competition Results—Home

Railway Nightmare Problem. This month we announce the list of prizewinners in the "Home" section of this competition. The number of errors estimated by the various competitors ranged from twenty to 200, but many boys lost their chance because their entries enumerated errors that did not exist, and which, of course, had to be deducted from their totals. The prizes were awarded as follows:—

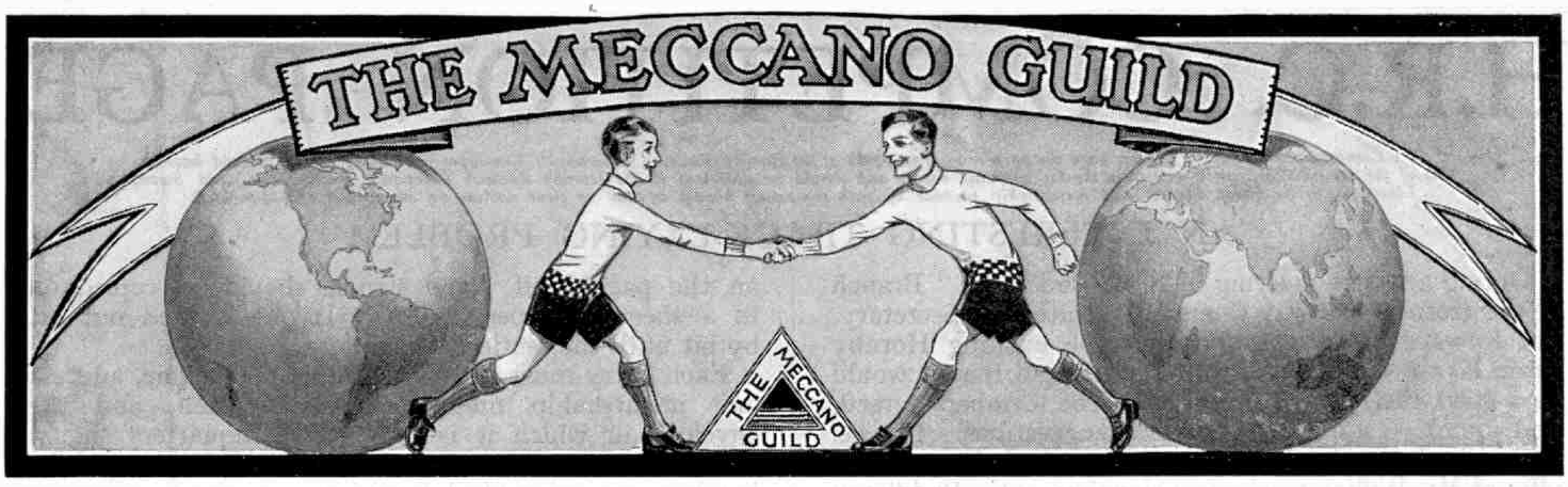
First (£1-1-0) P. H. Connell, No. 405 (Purley, Surrey); Second (15/–) S. Lucas, No. 2942 (London, N.18); Third (10/6) A. Fieth, No. 3037 (Rock Ferry); Fourth (5/–) G. Houghton, No. 2893 (Preston).

Consolation prizes have been awarded to L. Grugeon, No. 4023 (Swindon); C. M. Furst, No. 451 (Joppa, Midlothian); C. F. Wright, No. 48 (Ladywell, S.E.13); L. F. Harris, No. 4226 (London, S.E.15); R. Brocklehurst, No. 935 (London, N.E.13); D. A. Miller, No. 107 (Birkenhead); K. Costain, No. 5108 (Bolton, Lancs.); J. E. Garratt, No. 3282 (Coulsdon, Surrey); John Rogers, No. 2259 (Broadstairs, Kent); and G. L. Steggles, No. 116 (Petworth, Sussex).

Shunting Problem Contest. This contest proved very popular. The majority of solutions were quite ingenious and showed that great care had been taken. Several members even went to the trouble of making novel little sketches illustrating each move made by the two goods trains.

First prize (15/–) G. Cowlin, No. 2025 (Stockport); Second prize (10/6) D. M. Walbourn, No. 2896 (Theydon Bois, Essex); Third prize (5/–) R. E. Young, No. 2878 (Edinburgh).

Consolation prizes have been awarded to:—G. Lambert, No. 3270 (Derby); A. Dalrymple, No. 2563 (Bradford, Yorks.); F. H. Jaekel, No. 2903 (Radlett, Herts.); H. B. Leech, No. 3672 (Cheadle, Cheshire); J. Knight, No. 2978 (Milwich Hall, Nr. Stafford); G. H. Ravenor, No. 2706 (London, N.5); A. L. Jones, No. 5094 (Abergavenny, Mon.); W. T. J. Rutter, No. 3090 (Hereford).



With the Secretary

Take Photographs this Summer!

I am glad to learn from my correspondence with club Leaders and secretaries that this year preparations for the Summer Session are being made on a more extensive scale than in any previous year. Club spirit among members is now so strong that in practically all cases a definite summer programme is possible, and if the weather is favourable the coming summer will see a record number of club excursions and outings of all kinds.

One thing that I hope will not be forgotten is the use of a camera! I feel that more photographs of the outdoor activities of clubs should be taken, and I hope that this year will show a great improvement in this respect. It is during the summer that the finest club photographs may be obtained, for there are endless opportunities of securing interesting snapshots of episodes in camp, or during games and rambles.

Usually there is very little difficulty in obtaining photographs, for in most clubs there is at least one member who possesses a camera and is capable of acting as official photographer. If his work is well done he will find that his snapshots are a source of great interest to members, and he will be able to recover the small outlay necessary by making a small charge for the prints. I hope that every club will endeavour to make an arrangement of this kind, and that secretaries will take care to send me prints of interesting occasions and events. In order to encourage them to do so, I have decided to offer prizes of £2/2/–, £1/1/–, and 10/6, for the three most interesting photographs showing the outdoor activities of Meccano clubs. No special conditions are attached to the competition, and all photographs of this type received at Headquarters on or before 2nd September, 1929, will be regarded as entries.

In southern latitudes the summer is now at an end, and members of clubs in South Africa, Australia and New Zealand are settling down to their winter programmes. Entry in the present competition therefore is limited to home clubs and I hope to announce a similar one later in the year for overseas clubs.

Meccano Club Secretaries

No. 16. Stanley Weller

S. Weller is the energetic secretary of the Woolwich and Plumstead M.C. The club was affiliated as recently as March 1928, and in little more than a year its active membership has increased from 20 to more than 60. Weller's unflagging energy and resource have been of great assistance in arranging a varied and attractive programme, in which boxing and similar sports figure prominently.

Useful Publicity

It should be the aim of every Meccano Club to become as widely known as possible in its particular district, as this is one of the surest ways of increasing membership and of obtaining influential and valuable support. A very effective means of doing this is to appoint one member of the club as Press or Publicity Secretary, to whom is allotted the duty of sending reports of meetings, and notices of coming events, to the local newspapers. This is not a difficult task, but requires a little care and forethought. Editors of local newspapers usually are very pleased to receive short and accurate accounts of meetings of societies such as Meccano Clubs, provided they are sent in regularly and promptly. These conditions are very important, and the Press Secretary should ascertain the latest date for acceptance of contributions of this kind, and take care always to be well ahead of time. On his efforts depends the editor's opinion of the club, and any slackness or irregularity will lead him to think that members are not enthusiastic and the club is unworthy of notice.

Exhibitions and other open events may be made to play an important part in any scheme of publicity. Judicious advertising and notices in the local press bring these to the notice of the public, and when visitors have been attracted to the club room and have become interested in the display they should be given further information that will help them to form a high opinion of the work of the club. One Leader adopts the excellent plan of arranging a Publicity Stall on which are displayed photographs of previous Exhibitions and of interesting club groups. Copies of the "*Meccano Magazine*" also are available for inspection, those containing reports of the club's activities being folded in order to give prominence to the Guild Pages on which these appear. In addition, Merit Medallions won by members of the club and trophies awarded for competition among the members are exhibited on the stall, and attendants are at hand to explain the aim and purpose of the club to interested visitors and to distribute literature dealing with the Meccano Guild.

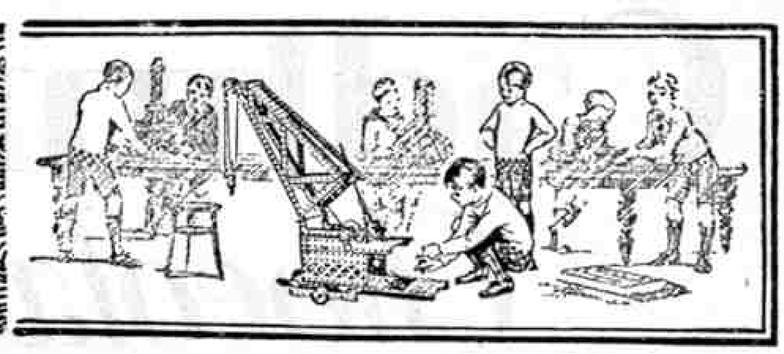
A Publicity Stall of this kind is sure to be a useful addition to any Exhibition, and I strongly recommend Leaders and secretaries to follow this example on every possible occasion. One great advantage of the plan is that a prospective member often is brought into touch with the club in the presence of his parents, who thus learn at first hand the exact nature of the organisation. In these circumstances it is practically certain that a boy interested in Meccano will receive every encouragement to join the club. Recruiting should be helped considerably by the adoption of this scheme, but its value for this purpose will depend very largely upon the character of the Exhibition itself, which should be good enough to convince visitors that the club is worthy of support.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters, whose names and addresses are given below:—

ALTRINCHAM—E. Morgan, 17, Princes Road, Altrincham, Cheshire.
BRISTOL—John Martin-Jones, 34, College Road, Clifton, Bristol.
KINGTON—T. Williams, Holmes Marsh, Lyonshall, Kington.
KING'S LYNN—J. P. Smith, Carleton Lodge, The Chase, King's Lynn, Norfolk.
NEATH—G. V. Rees, Bird-in-Hand Hotel, Neath, Glamorgan.
SUNDERLAND—Alfred McGregor, 7, Victor Street, Sunderland.

CLUB NOTES



Diss Church M.C.—A very lively Mock Parliamentary Election greatly interested members, and several party meetings were held at which many violent speeches were given. The Liberal candidate headed the poll, the Conservative candidate unfortunately being obliged to withdraw owing to illness. Games and Model-building have occupied other evenings, and a very successful Social has been held, when only one member was absent. Club roll: 34. *Secretary*: Mr. W. Hunt, 28, Mount Pleasant, Diss, Norfolk.

Lochgilphead M.C.—The Leader, who is well acquainted with Kinlochleven, where aluminium is extracted from its ore, gave an interesting talk on the metal and illustrated it with diagrams and pictures. The miniature Motor Show was highly successful. Model cars were judged on general appearance and originality, and their steering powers were thoroughly tested. Club roll: 13. *Secretary*: I. McCallum, Duncraoibhan, Lochgilphead, Argyll.

Broadwey and Upwey M.C.—Has resumed activities under the Leadership of Mr. R. H. Wright. Good progress is reported, and interesting meetings held have included Model-building and Hornby Train Nights. By kind invitation of the Leader of the Weymouth Central School M.C., members attended a special meeting of that club, when a Lantern Lecture on De Havilland aeroplanes was given. New members will be made welcome. Club roll: 11. *Secretary*: W. O. Doylend, Jestys Avenue, Broadwey, Weymouth.

Exmouth Y.M.C.A. M.C.—Has now become affiliated with the Guild, and membership is rapidly increasing. Model-building is the chief interest, and the many excellent models of original design that have been built include Rotating Cranes, and an Imperial Airways Aeroplane. Very interesting talks on "*The Building of the Panama Canal*" and "*A Trip to Cornwall*" have been given by members. A Concert and Exhibition closed the session. Club roll: 23. *Secretary*: Mr. J. Bulled, 2, Waverley Road, Exmouth.

Harpenden and District M.C.—A very successful Exhibition and a Concert attracted large numbers of visitors. At the Exhibition the models on view included a Beam Engine, Roundabout, Windmill, and Pit-head Gear. Model-building is always popular and there is keen competition on Meccano Nights. New members are still required, and boys who wish to join should apply to the secretary for full details. Club roll: 32. *Secretary*: A. Buck, Station Road, Harpenden, Herts.

Holy Trinity (Barnsbury) M.C.—A new feature in the Junior Section is a Shorthand class. This will be under the guidance of Mr. S. Bone, a former secretary of the club. An interesting programme of excursions for the Summer Session is being prepared. Club roll: 50. *Secretary*: Mr. F. W. Johnson, 23, Market Street, Edgware Road, Paddington, London, W.2.

Halifax M.C.—The Leader demonstrated the working of the Motor Chassis loaned from Headquarters. At another meeting a talk was given on "*How to Build Bridges.*" Games Nights are held regularly, Darts being one of the most popular recreations. Great activity is displayed in Model-building, and notable models include Cranes, Aeroplanes, Draglines, and a Viaduct for use in connection with the Hornby Train Lay-out. It is hoped to display a very large selection of the best models at the next Exhibition. Club roll: 20. *Secretary*: Mr. H. Ramsbottom, 155, Warley Road, West End, Halifax.

Pinxton Boys' M.C.—Has now reopened and is making good progress. By kind permission of the Pinxton Miners' Welfare Committee, the club meets in an excellent room at the Welfare Institute. A four-day Exhibition has been held, at which numerous prizes were offered, Model-building Competitions being open to all Meccano boys in the district. Weekly meetings are held on Fridays, and the secretary will be pleased to welcome intending members. Club roll: 28. *Secretary*: S. Winfield, 118, Park Lane, Pinxton, Nr. Notts.

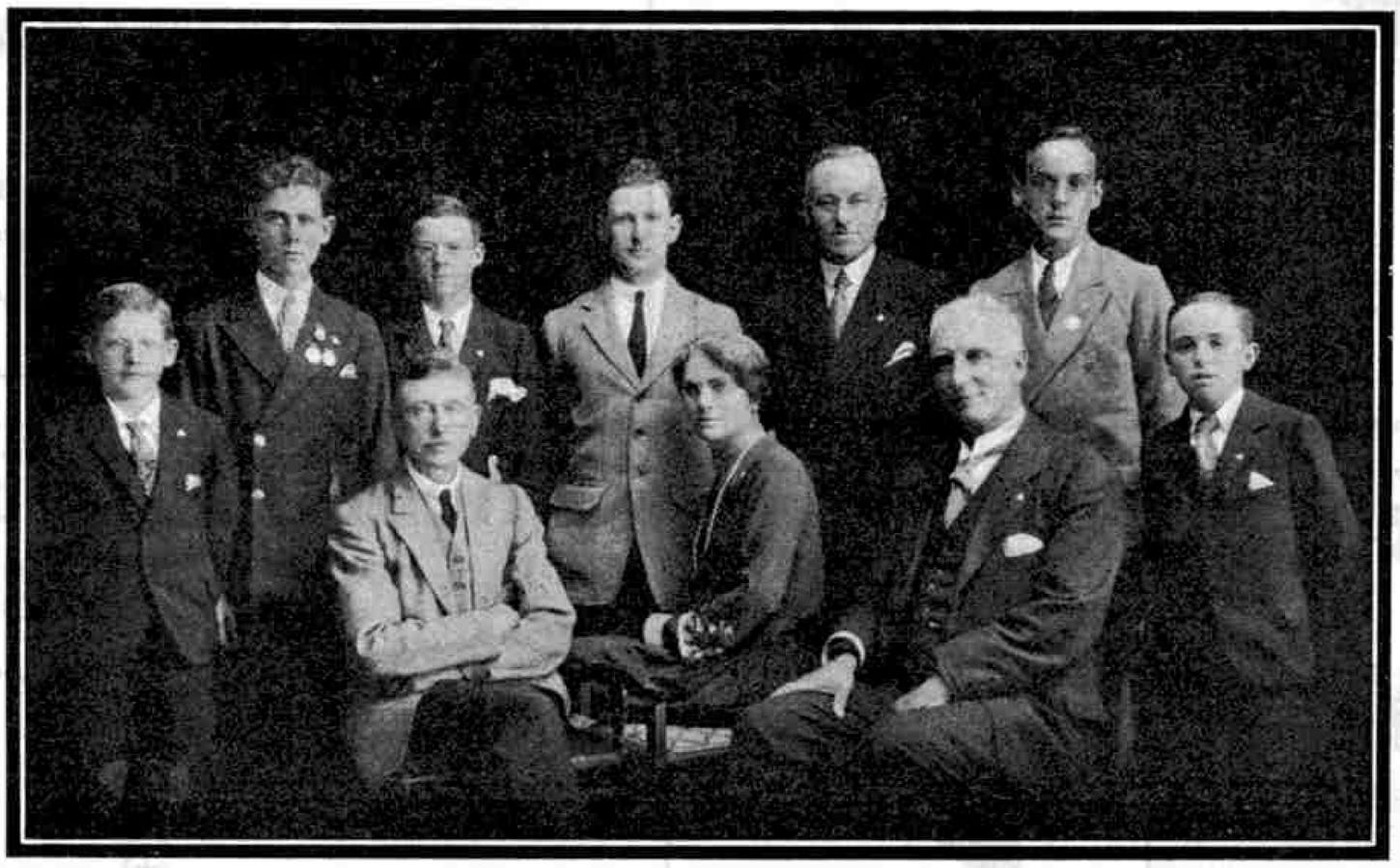
Pershore M.C.—Model-building Competitions are held monthly, the Leader giving small prizes of Meccano parts to the winners. A Lecture on "*The Story of Our Ships*" has been given. A Hornby Train Section has been started, and it is hoped that it will be incorporated as a branch of the Hornby Railway Company. Club roll: 10. *Secretary*: D. Cross, Church Street, Pershore.

South Dublin M.C.—The clubroom is now too small and members have been divided into two sections, the "*Wheels*" and the "*Cogs*," each section meeting in its own room. A Puzzles Competition was a new and popular feature. A series of puzzles had to be solved and members entered into the contest with spirit. Interesting Excursions and Visits are being arranged. Club roll: 16. *Secretary*: G. M. Foley, 44, Eaton Square, Terenure, Co. Dublin.

Stanley (Bootle) M.C.—Great interest is taken in Model-building and the standard is improving. A Lecture on "*Some of the World's Famous Bridges*" was given. A walking tour was arranged for Easter and the members thoroughly enjoyed the outing. Club roll: 6. *Secretary*: L. Hughes, 20, St. Albans Road, Bootle, Liverpool.

Whitgift Middle School M.C.—At a recent Exhibition entrance to the Model-building Competitions was open to the whole school. The prize for the most ingenious and interesting model was won by a member of the club with a Meccano Safe, which was lined with lead foil and fitted with a combination lock. It has been decided to divide members into two sections in order to make competition keener. Very successful Hornby Train Nights are often held. The track is laid to connect four form rooms, and trains are run to a timetable. Club roll: 35. *Secretary*: F. T. Brockes, 14, Addiscombe Court Road, East Croydon.

Sea Point (Cape Town) M.C.



The Sea Point M.C., since its affiliation in April, 1925, has made excellent progress under the able guidance of its President, Mr. G. E. Barrett, who is seated on the right in our photograph of the officials and committee of the club. The programme followed is distinguished by great variety, and a special feature is made of inter-club competitions with other Meccano clubs in Cape Town and district

Australia

Hobart (Tasmania) M.C.—Short talks by members are a special feature and one is given at every meeting. The club's first Mock Trial dealt with a murder case, and was so successful that further Trials are to be held. Model-building continues to be popular and models constructed by members have been exhibited in a local dealer's window. The "*Bolts*" won the Club Shield for 1928, leading the "*Nuts*" by 50 points. Many interesting visits have been arranged, and a Summer Camp has been held on a splendid beach. Club roll: 21. *Secretary*: Mr. F. Downie, 50, Letitia Street, North Hobart, Tasmania.

Hampton M.C.—The "*Tenders*" won the 1928 Competition, and the Shield was presented to them at a Social Evening. The President of the club, the Rev. F. P. Joseland, has been obliged to resign, as he lives at some distance from the club rooms, but he has promised to give active assistance when possible. A new and more suitable hall has been secured. The club now issues a Magazine, which is printed by the members themselves. Club roll: 20. *Secretary*: L. E. Jones, 34, The Avenue, Hampton, S.7, Victoria.

Canada

Kitsilans (British Columbia) M.C.—Interest is growing and membership increasing; two members actually travel seven miles each way to attend meetings. Many interesting Lectures have been given, one on "*Mountaineering*" being of special interest, as there are mountains more than 5,000 ft. in height only two hours by tramcar from Vancouver. The speaker gave practical demonstrations of the use of ropes, ice-axe, nailed boots, etc. Visits have been paid to the C.P.R. Engine Repair Shops, the plant of the Canadian Liquid Air Co., and the wonderful bridge across the Second Narrows of the Fraser River. A Stamp Section has been formed and members are now hard at work on a Model Railway. A collection taken at a recent Parents' Night was devoted to the purchase of wood, from which the members made large trestle tables to carry the track. These were on view at a second Visitors' Night held shortly afterwards. *Secretary*: Ronald A. Clarke, 2236, Yew Street, Vancouver, British Columbia.

Denmark

Odin M.C.—Model-building Contests are held regularly and competition is very keen. Large club models also have been built, an especially interesting one being the Eiffel Tower. All models built in recent Contests were displayed at the club's Exhibition, which was very successful. Club roll: 12. *Secretary*: A. Thiele, Langelinie 53, Odin.

New Zealand

Dunedin M.C.—Interest has been well maintained by Model-building Contests and other Competitions. These included Word-building and Slogan Contests, and a very interesting one in which members were required to recognise different makes of motor cars. Small prizes were awarded. The ships of the Byrd Polar Expedition created great interest during their stay in Dunedin Harbour, and members eagerly watched preparations and took many excellent photographs. The Hornby Train section holds regular meetings, and it is hoped that a branch of the H.R.C. will be formed. Club roll: 15. *Secretary*: T. MacLachlan, Art Studio, 66, Albany Street, Dunedin.

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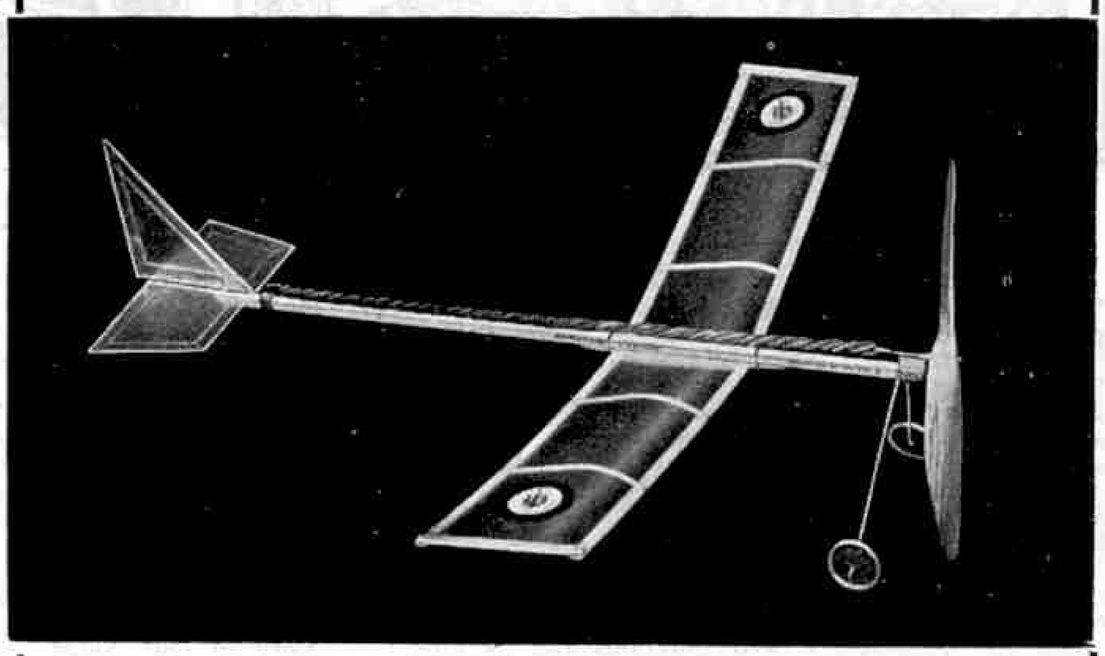

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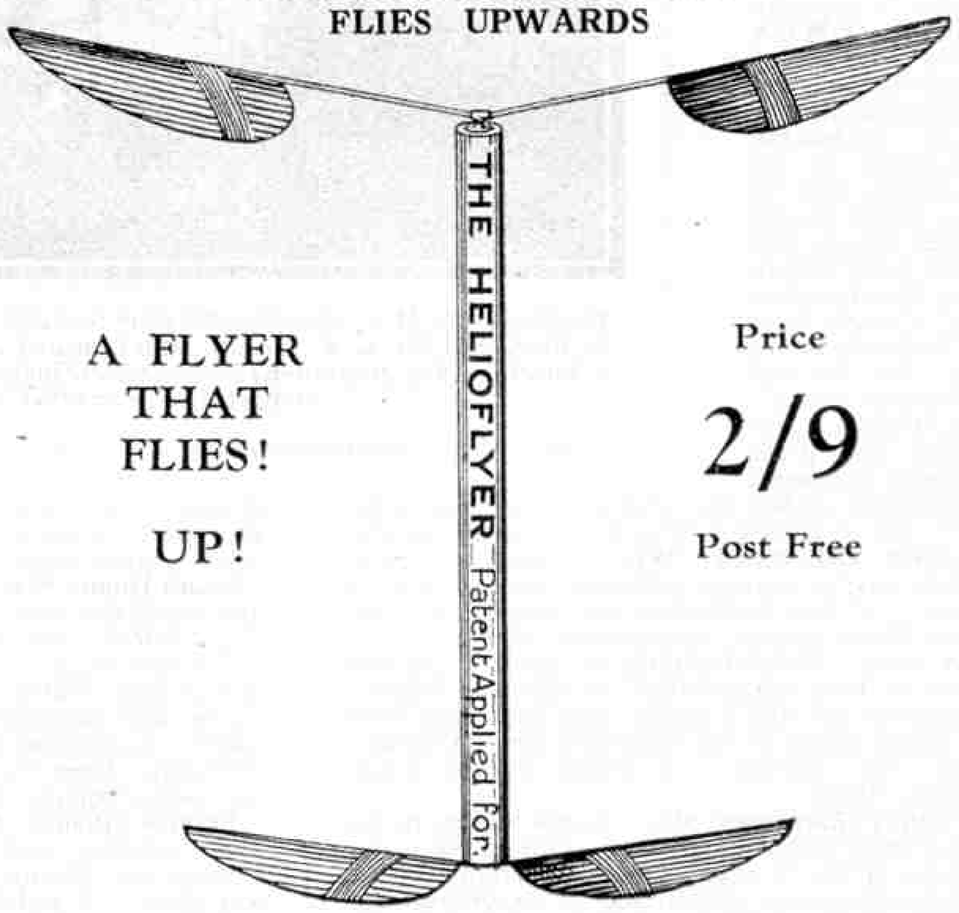

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Competition Page

"Limerick Skeletons"

A year or two ago we held some very successful Limerick competitions. Their popularity was clearly shown by the exceptionally large entries that we received, and from time to time readers have suggested that we should hold further competitions of the same nature. This month, therefore, we announce another Limericks contest, but on rather different lines from the previous ones.

This month's contest is best described as a "*Limerick Skeletons*" Contest. On previous occasions we have required competitors to submit completely original Limericks, but in the present contest skeletons of three Limericks are provided, and these are to be completed by filling in appropriate words. The three skeletons will be found in the panel on this page, and the missing words are indicated by asterisks. Each asterisk indicates the absence of one complete word—not, it should be carefully noted, a syllable.

It should be understood clearly that the task is not necessarily to complete the Limericks in their original form, but to produce the best possible results from the skeleton provided.

Competitors may send in as many entries as they wish, but each one must be submitted upon a separate postcard, together with the full name and address of the competitor written clearly.

Cash prizes of £1-1s., 15/–, 10/6, and 5/– respectively will be awarded to the four best entries in order of merit. In addition, there will be a number of consolation prizes for other deserving attempts.

Postcards should be addressed: "Limericks, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should reach this office not later than 31st May. Overseas closing date, 31st August.

There was * * * * Kentucky
Who said * * always *
My skin is so dark
That when * * * *
The people all think * * *

There was * * * * *
Who biffed * * * * lid,
When they asked him what for,
He * * *,
"You didn't know father, * * !"

There was an old lady of Liverpool
Who hid * * * * *.
When asked * * *
That * * * *
She replied * * * * * * * *.

39th Photographic Contest

Our recent competition for the best story concerning a domestic pet produced such an interesting crop of yarns that we felt a desire to see some of the animals concerned. Unfortunately it is impossible for us to make their acquaintance in the flesh and, as the next best thing, we announce a Photographic Contest, the subject of which is "The Most Interesting Photograph of a Domestic Pet." In this contest the prizes will be awarded to the most interesting or amusing entries, and not to those that are the best photographs from a technical point of view.

Entrants will be divided into the usual two sections, A for those aged 16 and over, B for those under 16, and cash prizes of 10/6 and 5/– are offered for the two best photographs, in order of merit, in each section. In addition there will be a number of consolation prizes.

Entries should be addressed to "39th Photographic Competition, Meccano Magazine, Old Swan, Liverpool," and should be sent to reach this office not later than 31st May. Overseas closing date, 31st August.

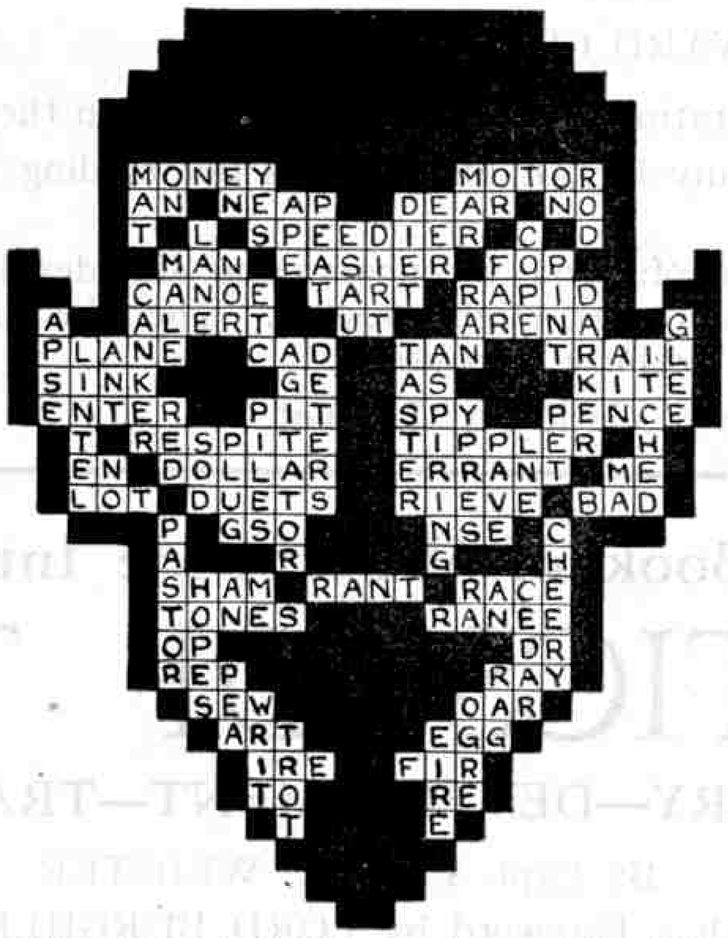
Entrants are reminded that their name, age and address must appear on the back of every photograph submitted. Photographs can be returned only if a stamped addressed wrapper of suitable size is forwarded with the entry.

"My Summer Holiday Plans"

At this season of the year most of our readers will be looking forward with keen anticipation to the long summer vacation, and making plans for some right royal times. In the majority of cases the place chosen for the summer holiday is more or less decided by general family considerations, but a large amount of freedom remains in the planning out of daily activities. Opinions differ as to the best holiday schemes, but everyone agrees that the main object is to obtain "100 per cent. fun per hour!"

We offer prizes this month for the best descriptions of "My Summer Holiday Plans." In each of two sections, A for those aged 16 and over, and B for those under 16, cash prizes of 10/6 and 5/– respectively will be awarded to the best two entries in order of merit. In addition, consolation prizes will be awarded to the next three entries in order of merit in each section. All entries should be written on one side of the paper only, and should not be longer than is really necessary to explain the competitor's plans.

Entries should be addressed: "Summer Plans, Meccano Magazine, Old Swan, Liverpool," and should reach this office not later than 31st May. Overseas closing date, 31st August.



The solution to the February Crossword Puzzle is given above

HOME RESULTS

Cover Voting Contest.—As usual this competition proved exceedingly interesting, the ballot for the popularity of the covers and the forecasting of the voted order being exceptionally close. The actual order as decided by the massed votes was: June, April, February, May, July, March, December, October, November, September, August, January.

No one gave an accurate forecast of the voting, but here again the competition was keen, only fractional points separating the first four successful entries.

The prizewinners are as follows:—1. J. A. Hutcheson (Cambuslang); 2. R. W. Newby (Bedford Park, W.4); 3. H. J. Willis (London, N.19); 4. T. Chatfield (West Worthing). Consolation Prizes: D. Herbert (Chiddingfold); T. E. Whittle (Chorley); D. Clift (Brixton, S.W.9); S. Quires (Dalston, E.8); A. McBride (Liverpool); E. W. Sherrington (Southall); C. A. Ball (Godalming); E. Smith (Edinburgh).

Boat Race Essay.—The entries to this contest, almost without exception, credited the popularity of the Boat Race mainly to the Englishman's traditional love of keen sport for sport's sake, carried out in the true team spirit, and in which financial considerations are never allowed to enter.

The prizewinners are as follows:—First Prizes: Section A, G. A. Adamson (W. Croydon); Section B, E. V. Morgan (Warwick). Second Prizes: Section A, S. T. Wills (Devonport); Section B, E. P. Peregrine (Carmarthen). Consolation Prizes: J. R. Farebrother (Norbury, S.W.16); R. H. Aldridge (St. Neots); S. Williamson (Sheffield); C. Booth (Doncaster); R. J. Gething (Griffithstown, Mon.).

OVERSEAS

Bottled Parts No. 2.—The awards were: 1. F. G. Glass (Brazil); 2. A. A. T. Khandwalla (Karachi); 3. F. Tyebali (Karachi); Consolation Prizes: E. G. Akerman (Newcastle, N.S.W.); S. F. Desai (India).

The complete list of numbers of the parts secreted within the bottle is given for the benefit of those competitors who wish to check their entries:—10, 20b, 23, 37a, 41, 44, 45, 50a, 55, 57b, 64, 65, 66, 77, 96, 114, 116a, 119, 127, 131, 134, 138, 142, 147, 150, 154a, 161, 162a, 163, 170.

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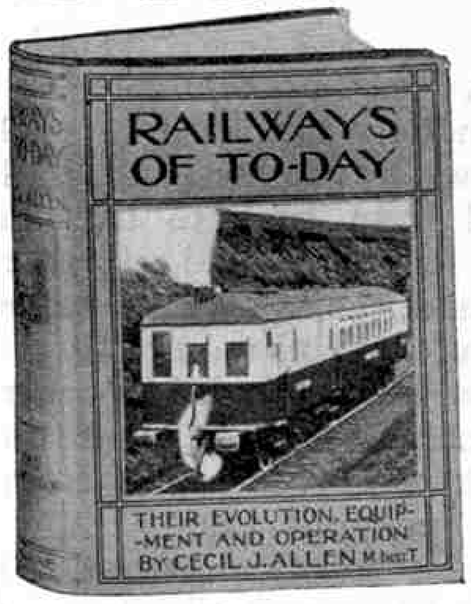

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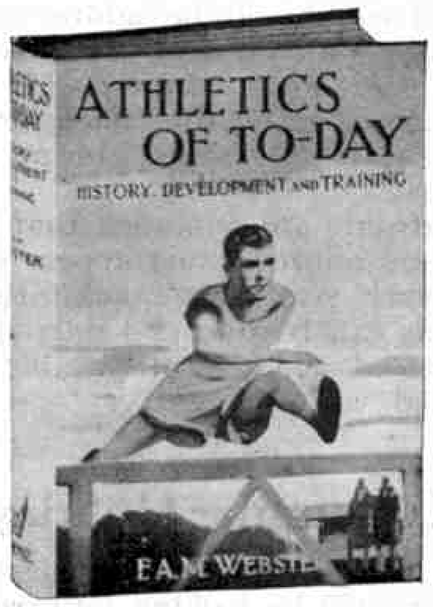
Long Distance Walking.
Throwing the Javelin.

Tug-of-War. Etc., etc.



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Fireside Fun

NOISES OFF

A story is told of some new Council houses in a northern town. A tenant, who had recently moved in, was entertaining a friend one afternoon. The visitor was shown round the house, and admired everything very much. He had been sitting down again for a few minutes when he asked, suddenly, "Have you got mice here, then?"

"Mice! Gracious, no!" said the occupier. "What makes you ask?"

"Well, I thought I heard some—listen, there's the noise again! Don't you hear them nibbling?"

The other listened for a minute, and then answered with relief: "That's not mice. It's only the people next door eating celery!"—"*Manchester Guardian.*"

* * * *

"A brave soldier is always found where the bullets are the thickest. Now, where would you be found Smith?"

"In the ammunition wagon, sir."

* * * *

Teacher: "Tom Smith, how often am I to tell you not to work and whistle at the same time in school?"

Tom: "Please, sir, I wasn't—I was only whistling."

* * * *

Chatty old gentleman on bus: "Conductor, I don't know how you fellows manage to do all the writing you do when the bus is travelling over roads as bumpy as this."

Conductor: "You'd soon get used to it, sir. When I want to write a letter at home I have to get the wife to shake the table for me."

* * * *

Customer: "Are you sure the beaver fur coat will be warm?"

Salesman: "Yes, madam. The fur in this coat came from beavers that died of suffocation."

* * * *

New Office Boy: "I've added those figures up ten times, sir."

Employer: "Good."

New Office Boy: "And here are the ten answers, sir!"

* * * *

THE BEST WAY

Farm Labourer (on top of half-finished haystack): "How be Oi agoin' to get down, Bill?"

Friend: "Why, shut yer eyes, Garge, and walk about a bit."

* * * *

Lady: "Why are you crying?"

Boy: "Auntie has fallen down the stairs."

Lady: "But she will soon get better."

Boy: "I know, but my little sister saw her fall and I didn't."

* * * *

"Why didn't you try to keep out of gaol?"

"I did, ma'am, and I got two months extra for resisting the policeman."

A great scientist was giving a lecture to the members of a local society.

"Calculating on the lines I have mentioned, I should say the end of the world will come in three hundred and fifteen million years," he said.

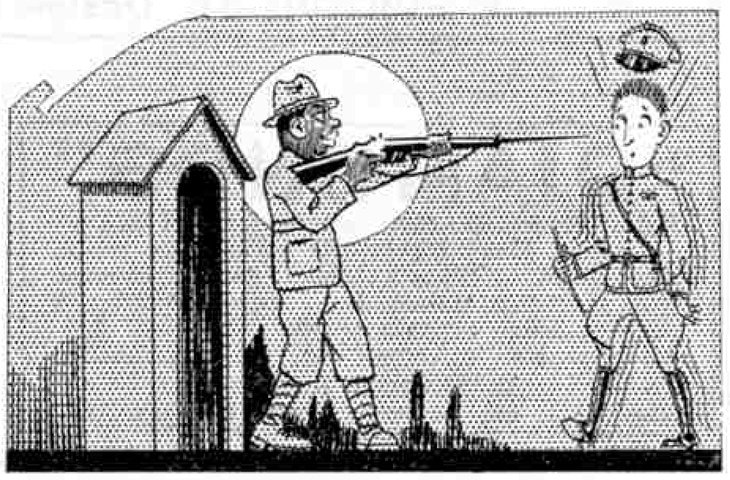
A little man in the front row showed signs of alarm. "How many years did you say, sir?" he queried.

"Three hundred and fifteen millions," replied the scientist.

"That's better," said the inquirer, with a sigh of relief. "I thought you said fifteen millions."

* * * *

AWKWARD



Darkness was just falling and the coloured sentry was on duty for the first time, when suddenly he heard a sound.

"Halt! Who goes there?" he challenged.

"Your commanding officer," came the reply. The officer then moved on, but again the challenge rang out. "Halt! Who goes there?" and the sentry raised his rifle to his shoulder.

Much mystified, the officer shouted in alarm: "Hi, my man, what are you going to do?"

"Never you mind what Ah'm gonna do," the sentry retorted. "Ah've had my instructions. Ah'm gonna challenge three times and then shoot."

* * * *

Client: "My next-door neighbour has built a high fence near my drawing-room window, thus darkening the room. I'm sure he's done it out of spite. What can I do?"

Lawyer (glancing up from papers): "Light the gas. Six-and eight, please."

* * * *

Magistrate (very sternly): "You are found guilty of knocking down the plaintiff and robbing him of everything except his gold watch. What have you to say?"

"Had he a gold watch?"

"Certainly."

"Then, sir, I put in a plea of insanity."

* * * *

Mr. Boreham (discussing integrity of a friend): "I assure you he's all right. Why I'd trust him with my life!"

Mr. Feddup: "But supposing he had his hands on something valuable."

* * * *

Manager: "Jones, how is it you've been away?"

Junior Clerk: "Please, sir, I have a certificate from my doctor saying that I could not work yesterday."

Manager: "That's no use. I could give you a certificate saying that you never could work."

* * * *

First Doctor: "Tell me, Doc., have you ever made a serious mistake in diagnosis?"

Second Doctor: "Yes, once. I told a man he had a touch of indigestion. Afterwards I found he was rich enough to have had appendicitis."

* * * *

The Sunday school teacher had been talking to the children about various virtues.

"Now, supposing I saw a boy ill-treating a donkey," he said, "and I stopped him; what virtue should I show?"

"Brotherly love," replied a young innocent.

THE TEST

A teacher sent a small girl for sixpennyworth of plums, telling her to be sure and pinch one or two to see if they were ripe.

Presently the girl returned. "'Ere, teacher," she said, "'ere's yer sixpence. The man wasn't lookin', so I pinched the lot."

* * * *

The shopper was very hard to please, and the salesman, who had shown him almost every pair of field-glasses in stock, was reaching the end of his patience.

"Are you sure these field-glasses are all you say?" queried the shopper.

"More than that, sir," replied the salesman. "Why, they are so powerful that anything less than five miles away appears to be behind you!"

* * * *

Jones: "Women, I am of the opinion, are different now from what they used to be."

Brown: "How's that?"

Jones: "There's my daughter, for instance, she's taking up the law, whereas her mother always lays it down."

* * * *

Harry: "Hullo, Bill! I haven't seen you for twelve months. What have you been doing?"

Bill: "Twelve months."

* * * *

An Irishman and an Englishman were watching the Niagara Falls. "Isn't it wonderful?" exclaimed the Englishman.

"Phwat's wonderful?" asked the Irishman.

"Why," said the Englishman, "all that water falling, of course."

"Shure," said the Irishman, "and phwat is there to hinder it."

* * * *

The following advertisement appeared in the columns of an Indian paper:—"Mahomedsman, hair-cutter and clean shaver. Gentlemen's throats cut with very sharp razors, with great care and skill. No irritating feeling afterwards. A trial solicited."

* * * *

The American visitor was buying an evening paper in the street. "Gee!" he said to the newsboy. "Only a penny, eh! Wal, I guess I'd hev to pay double or treble that in America."

"Well, sir," said the lad smartly, "go ahead and make yourself at home."

* * * *

"Remember that Scotch friend of mine? He sent me his photo."

"How does he look?"

"I don't know, I haven't had it developed yet."

* * * *

ITS ONLY FUNCTION!

Old Lady: "And now, Officer, tell me what that strap under your chin is for."

Officer: "That, lady, is to rest my poor old jaw when it gets tired of answering silly questions."

* * * *

Scene: Gloomy and dust-laden curiosity shop.

Enter dear old lady, very short-sighted.

D.O.L. (after ten minutes of groping around in search of priceless antiques): "I don't see anything really antique, but stay! How much is that hideous old idol near the door? That must be worth a lot of money."

Assistant: "Yes, mum, it is. It's the boss."

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THE CONGO PACKET

The Belgians are honouring England's great Explorer, H. M. STANLEY (to whom they owed so much for his work on the Congo) with a special issue of stamps bearing his head. I am therefore offering a packet of *African Stamps only*, representing most of the countries he explored and the adjoining States. ALL are GOOD CLASS Stamps. NO COMMON Continentals. GOLD COAST, NIGERIA, PORTUGUESE CONGO, a fine set of KENYA & UGANDA, MIDDLE CONGO, EQUATORIAL AFRICA, QUILEMANE (ZAMBESIA), IVORY COAST, RUANDA-URUNDI, RHODESIA, NIGER, ANGOLA and many others. Price 4½d., postage 1½d. extra. In addition to this I am presenting all who ask to see my approval sheets a SPLENDID set of **10 CONGO** (including the Stanley Stamps) usually sold at **1/-**. Senders of addresses of stamp collecting friends will receive a free set in addition. List of 700 sets and packets, **1d.** extra.

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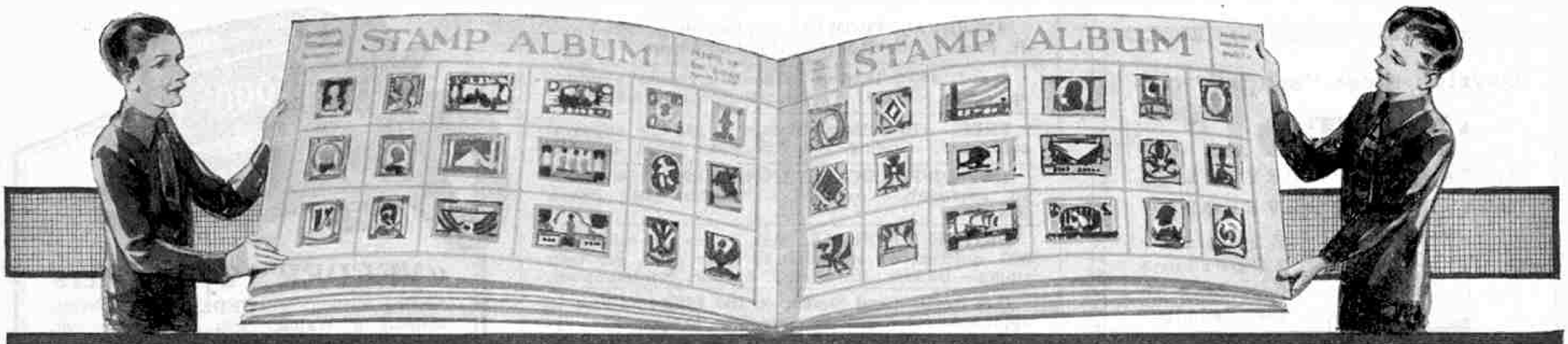

STAMP COLLECTING

ENGINEERING STAMPS (IV): ANCIENT ARCHITECTURE

NO record of engineering feats as presented by the pages of a stamp album would be complete without some reference to the wonderful achievements of the engineers of ancient Assyria, Egypt and Rome. Although little beyond tumbled heaps of ruins remain to show what was accomplished, the methods that were employed will always be a source of marvel. There is clear evidence that these engineers attained a high degree of technical skill, but no trace can be found of the mechanical appliances that must have been used in the creation of such vast structures as the great Pyramid of Cheops at Giza, the first wonder of the world.

The Egyptian pyramids are familiar objects to all stamp-collectors, for in company with the Sphinx, they formed the design for Egypt's stamps for a period of nearly 40 years, from 1867 until 1906, when they were displaced by a new issue dealing with these and other architectural and engineering wonders of early Egypt.

The biggest of the three pyramids at Giza, shown on the 4 mils. value of the 1906 issue, is the largest building in the world, and required the labour of over 100,000 men for more than 20 years. It was the outcome of a whim of the tyrannical King Cheops, after whom it was named, who reigned over Egypt in 3700 B.C. He conceived the great Pyramid as an appalling task for his people and a tomb in which his remains and property could rest undisturbed after death. His work was set at nought, for ages ago the death chambers were stripped of all their relics.

The great Pyramid is 480 ft. in height—about 150 ft. higher than St. Paul's Cathedral—and has a base 768 ft. square, thus covering more than 13 acres. The stones used in its construction are in no case less than 30 ft. in length. They were quarried in the Arabian Mountains and brought down to Giza by the River Nile. Their transport from the river to the site of the work necessitated the construction of a special roadway of polished stone, 60 ft. in width and three-quarters of a mile in length. This alone called for 10 years' work!

The 5m. value of the 1906 issue, also illustrated here, shows the great Sphinx, the largest single piece of sculpture the world has known. With the exception of a small temple, built between the front paws, and the paws themselves, the whole is carved out of one piece of rock. This Sphinx is believed to have been built at Giza as a guard over the entrance to the great Nile Valley. It has the body of a lion crouching, with the head of a man, and is 146 ft. in length and 34 ft. in breadth. To the top of the head it is 100 ft. in height, the height from the chin being 28 ft. 6 ins.

The huge size of the Sphinx can best be illustrated by a comparison of its head with the bulk of an ordinary human head, which is 40,000 times smaller! The moving of this gigantic piece of material is probably the world's most remarkable transport feat, and the secrets of its accomplishment will probably remain clouded in mystery for ever.

The 20m. stamp of the Egyptian series shows one of the great pylons built at the temple of Karnak, near Luxor, in the famous Valley of the Tombs of the Kings. This great temple covers an area of nearly 420,000 ft., approximately five times as large as the floor area of St. Paul's Cathedral. Its greatest feature was a wonderful hall, 342 ft. in length and 170 ft. in width, the roof of which was supported by 138 massive stone columns arranged in 14 rows of nine columns each, 43 ft. in height, and two rows of six columns each towering up 62 ft. and having a base diameter of 11 ft. 6 in.

An interesting example of an early brick structure, the famous Ctesiphon arch built in 550 A.D., is to be found on the 3 anna value of the Mesopotamian issue of 1923. This, like the Egyptian series we have just mentioned, was devoted principally to illustrating the country's architectural wonders. The arch originally formed the roof of an immense hall, known as *Takhti Khesra*, the "Throne of Khosrau," and was 95 ft. in height, 83 ft. in breadth and 163 ft. in length. To take the outward thrust of the arch, smaller halls were built on both sides, and probably these were used as guard chambers and store rooms. The building was of burnt brick throughout and is one of the very few arched buildings of the 6th century that still remain.

Undoubtedly the best existing example of the colonnaded style of Roman street architecture is illustrated on the 2p. and 25p. Syrian issues of 1925. These show a ruined street of Palmyra, flanked by magnificent columns of the Corinthian order, each 31 ft. in height. The central avenue between the columns was open to the sky, but the side avenues were roofed over with stone. The street was nearly a mile in length and 70 ft. in breadth.

Another interesting example of Roman engineering is found on the higher values of the 1906 issues of Tunis, from which we illustrate the 40c. value, depicting the remains of a great aqueduct built by the Roman Emperor Hadrian to carry water from Zagwhan to Carthage. The ruins that remain still show hundreds of the great stone arches in position and they stand as a remarkable testimony to the skill of the engineers of ancient days, and the durability of their works.

There is considerable scope for an extensive research into ancient engineering as revealed on stamps, and we have but barely skimmed the surface in this article. Among stamps that we have not space to illustrate, reference must be made to the 2 fr. value of the Tunis 1926 issue, which shows the great Roman amphitheatre at El Djem in Tunis. This building measures 376 ft. by 220 ft. Britain's famous amphitheatre, the Royal Albert Hall, at its widest point, only measures 276ft. across.

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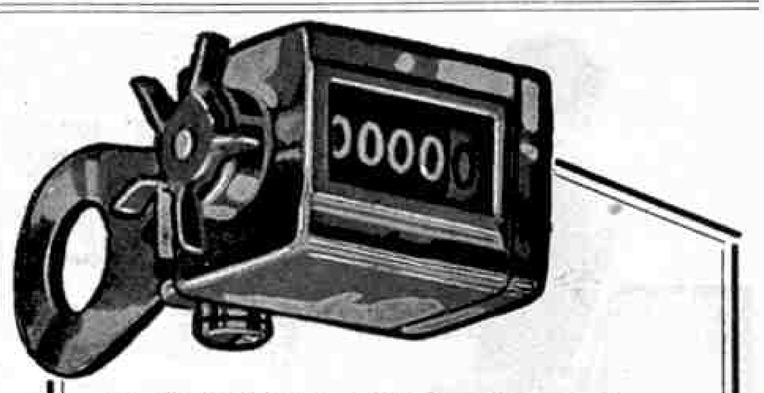

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CYCLING HOLIDAYS:
Fun on the Open Road

The enormous increase in the amount of motor traffic has done a great deal towards spoiling the roads for cyclists, and some cyclists appear to have abandoned touring altogether. This is a great pity, because tours may be as enjoyable as ever provided that the necessary attention is given to choosing the route. Obviously there is not much fun in riding mile after mile along a main road that is a seething mass of motor traffic, but fortunately this is not necessary. Probably nowhere else in the world are to be found such interesting by-roads as in the British Isles, and careful study of a map and a guide book will make it possible to select a tour that will include few roads where motor traffic is heavy enough to be disagreeable. To cyclists who have never attempted a tour the project may appear to be something of an adventure. It is indeed an adventure, and therein lies its greatest charm.

In planning a tour, careful regard should be had to the nature of the ground that is to be covered. In hilly country such as North Wales, Derbyshire, or the Lake District, the mile average per day will of necessity be lower than in the case of a flat district. There is nothing more certain to kill the enjoyment of a tour than the feeling that one is riding against the clock. The object of a tour is healthful recreation, not the piling up of a big mileage; and the distance allotted to each day should be one that can be covered easily and comfortably. In this manner it becomes possible to enjoy the surrounding scenery as one rides along; to visit places of interest that are not too far from the road, and to partake of refreshments quietly and comfortably.

The road map and the guide book should always be taken along, for they not only add very greatly to the interest of the ride, but at times may prevent a mistake in the road or the missing of something of interest.

A solitary tour is not, as a rule, a satisfactory affair; on the other hand a crowd is even worse. Usually it is most satisfactory to have just one or two friends upon whom one can rely for good companionship and good humour. If it is at all possible a camera should be taken along to provide a photographic record of the tour that will serve as a source of pleasant remembrance in after years. Small folding film cameras are so perfect nowadays, and the resulting negatives are so easily enlarged, that it is foolish to carry an instrument larger than can be tucked away in a pocket.

In order to avoid any worry on the part of parents it should be made an invariable rule to write home each day, and it is sometimes a good plan to arrange to send a telephonic "All's Well" from a certain place at a certain time.

The kind of tour that is to be undertaken depends very largely upon financial considerations. If funds are fairly flourishing, one can enjoy the luxury of sleeping between sheets each night. On the other hand, if times are hard, it may be necessary to plan a camping out tour; and provided that the weather is kind this is a healthier plan, and it certainly provides more fun!

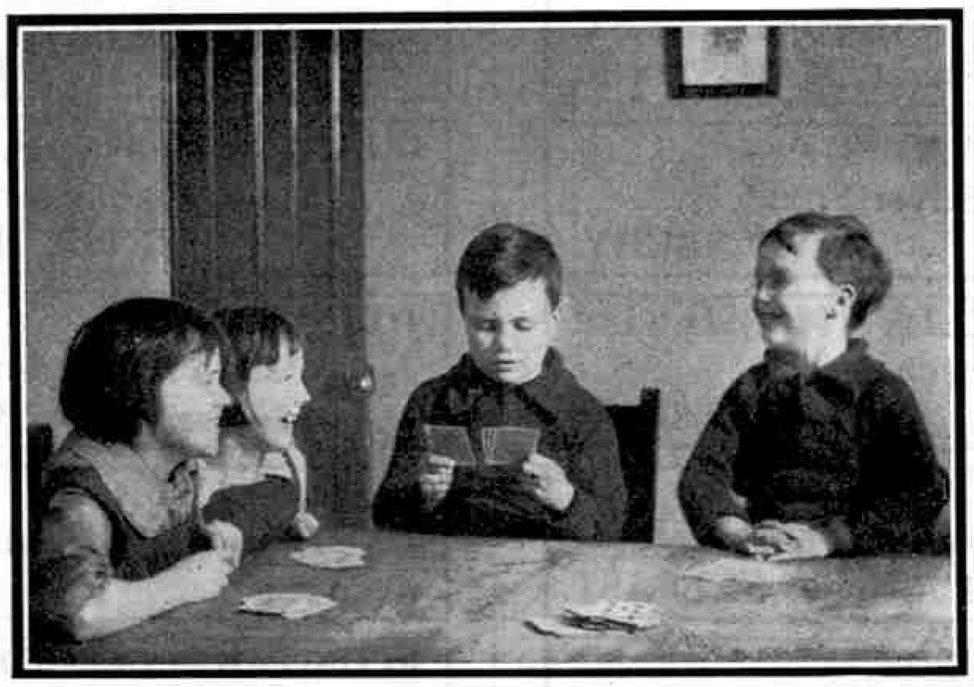
For the camping out tour all that is required is a mackintosh sheet to lie on and some form of waterproof covering to form a sleeping tent. Even these are not necessary if it is decided to take a chance and sleep in barns, for which permission can generally be obtained from some well-disposed farmer. Straw makes fine bedding, warm and comfortable, and the barn provides the overhead shelter.

Next month we shall discuss the kit and equipment for a tour.

WHAT CAN BE DONE WITH A SMALL CAMERA:
How the Beginner Goes Wrong

It will be appropriate to devote the first of our photographic articles for this season to a consideration of the essentials that make for enjoyment or disappointment in photography, and particularly to deal with the problems of the boy who is taking up the hobby for the first time. So many people, with all the real enthusiasm of new devotees, rush to buy a camera, buy the most costly one they can afford, fly off and snapshot everything and anything that comes along, and then find two-thirds of their exposures are hopeless failures. Some discover the cause of their mistakes before long; others never find out, and these, before many months have passed, give up photography in disgust, declaring it to be too expensive a hobby.

Photography need not be expensive, provided the would-be photographer considers ways and means before he buys his camera, and takes care to give the instrument a fair chance to record the pictures he wants it to make.



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A box-form camera of tiny size is capable of achieving results equal to those secured with the biggest and most expensive instruments. The difference lies in the fact that the more expensive equipment can turn out good results under conditions that are impossible for the cheap camera. The expensive camera has a big lens and a many-speeded shutter, while the cheap camera probably has only one snapshot speed and a lens of small aperture.

To make our point clear it would be well to explain that the act of opening the shutter allows a certain quantity of light to pass into the camera—the larger the aperture of the lens the greater the amount of light passed. The quantity of light thus admitted decides the fate of the film. If it is either insufficient or excessive for the particular subject that is being photographed, the exposure is either partially or entirely a failure. In good light conditions the small cheap camera passes as much light as is necessary to give a perfect exposure, but it cannot possibly have the wide range of a camera with an expensive lens.

Obviously, then, if the owner of a cheap camera wishes to secure good results he must consider the limitations of his instrument and not attempt the impossible. Snapshots in the late evening or indoors, or subjects moving at high speeds near to the camera, are out of the question.

The tiny size of the film employed in the cheap camera has no bearing upon the results. The contact print from a good small picture has all the quality of the post-card photograph, and if desired it can easily be enlarged to this size. If, on the other hand, the tiny picture is a failure, the cost of scrapping it is infinitesimal in comparison with the cost of large-size films. It is indeed an advantage to have a small camera, for the running costs are considerably less. The position may be summed up thus: the small camera gives more snaps to the pound than its bigger brother!

If every photographer would take the small amount of trouble involved in learning the limitations of his camera, the old cry "photography is expensive" would soon be a thing of the past.

In considering the possibilities of the small camera we have disregarded the question of whether plates or films are to be used, simply because very few amateur photographers use plates nowadays. The handiness of roll films has made them pre-eminently the material for the photographer who is out simply for enjoyment and to secure pictorial reminders of his fun.

Many young photographers fail to realise that, for all practical purposes, the fate of the film is decided at the moment the shutter opens. In our next article therefore, we propose to deal with the problems of exposure, and the use of the camera generally.

"Holiday Haunts"

This year's edition of the familiar G.W.R. publication, "*Holiday Haunts*," more than maintains the excellence of its predecessors. It forms a complete guide to the whole of the places of interest served by the company, the interesting summaries of the outstanding attractions of the various places dealt with being accompanied by illustrations on a profuse scale. The only criticism of this remarkable handbook that can be made is that it provides an embarrassment of riches and makes one long for a twelve months' holiday in which to visit all the places mentioned!

"*Holiday Haunts*" may be obtained at the price of 6d. at all G.W.R. stations, agencies and bookstalls, or from the Superintendent of the Line, Great Western Railway, Paddington.

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The Story of Rubber—(*Continued from page 378*)

that it contains. As the latex flows better during the early morning, tapping of the trees in each area is commenced about 6 a.m., each tapper dealing with from 300 to 500 trees, according to his capacity and the contour of the area allotted to him. The strips of bark that are pared off the trees have a certain amount of latex adhering to them and they are collected.

The tapper arranges his route so that the last few trees to be dealt with bring him back to his starting point. He then obtains from the factory two pails, one of which he fills with water, and armed with these he sets out on a second tour of his district. By this time the latex in the trees that were tapped early has ceased to flow, and commencing with these the native goes along emptying the cups of latex into the empty pail. A small amount of latex adheres to the cup when it is emptied, and the native removes this by washing the cup in the pail of water. Instead of washing the cups in this manner it is the practice at some plantations to allow the remnants of the latex to dry and then to remove it in the form of a thin film. This is known as "cup-washings scrap," and at the factory it is worked up into Crêpe Rubber, to which we shall refer next month. The work of emptying the cups is carried out swiftly, for the latex coagulates, and a naturally-coagulated latex cannot be converted into the finest form of rubber. (*To be continued*)

How to Use Meccano Parts—

(*Continued from page 389*)

through them and inserted in the holes of new style Collars carried on the 3½" Rod, these bolts serving also to secure the Collars to the Rod. The lower end of the latter may be secured to the model by a Crank or any other suitable means.

Another excellent illustration of the adaptability of Sleeve Pieces in forming chimneys, etc., will be found in the Meccano Giant Dragline (see Special Instruction Leaflet No. 27).

Besides the uses of the Chimney Adaptor mentioned above, this part may be employed for several quite different purposes. In Fig. 2 it is shown as the oil receptacle in a Meccano syphon lubricator. The Adaptor is bolted just above the journal bearing and the oil is led through a piece of wool, which is encased for part of its length in Spring Cord, to the set-screw hole of the Double Arm Crank that forms the journal bearing.

Face Plates (part No. 109) are included in Class N (Wheels, Pulleys, etc.) and therefore will be dealt with in a future article in this series.

Producing the "M.M."—(*Cont. from page 361*)

condition and colour, and are carefully sorted on arrival at the paper mills. They are then cut into small pieces and shaken thoroughly in a revolving drum lined with fine wire mesh in order to remove dust and dirt. Then follows a boiling process that removes chemical impurities and, at the same time, softens the material. The rags are usually boiled in caustic soda for several hours, after which they are reduced to a rough pulp in a "breaker" containing revolving knives that tear and rend the material in such a manner that the fibres are separated. Water flows through the machine during the operation, at the end of which the material is thoroughly broken up and is in the condition known as "half-stuff." By subsequent processes of bleaching and purification it is reduced to a pulp suitable for paper-making.

Esparto undergoes somewhat similar treatments. After the removal of dust, it is boiled with caustic soda in large cylinders, capable of holding from 2½ to 3 tons of grass. The boiled grass is then transferred to a breaking machine where it is washed and broken down into "half-stuff" exactly as in the case of rags. On the Continent certain varieties of straw are sometimes used instead of esparto. The straw is boiled with caustic soda and broken in the same manner as the grass, but it requires more drastic handling.

Story of the Bell—(*Continued from page 358*)

When these delicate adjustments have been made the clapper, which is moulded and cast separately, is fitted into place and the bell is given a final testing for trueness of tone after which it is ready for dispatch.

Mention has been made already of the recent casting by the Croydon Bell Foundry Ltd. of the largest bell ever produced in this country. Another bell of almost equal size was cast by the same foundry in 1926. This bell weighs 18¼ tons, to which must be added the weight of the headstock and the clapper, amounting to approximately 7¼ tons. It is one of four to be hung in the clock tower of the Riverside Drive Church, New York, and being the "bourdon," or largest bell of the group, it will sound the hours.

Among large contracts recently carried out by the Croydon Bell Foundry Ltd. is one for a carillon of 49 bells for the Wellington War Memorial, New Zealand, and another for a carillon of 32 bells for the New Regal Cinema, London. The completion in May last of a carillon of 48 bells for the University of Louvain, Belgium, was made the occasion for a visit to the foundry by the Belgian and the American Ambassadors, the Burgomaster of Louvain and the Lord Mayor and the Sheriffs of London. The total weight of the Louvain carillon is 31¼ tons and it is the largest in the Eastern Hemisphere, the next largest being that at Malines Cathedral, which has 45 bells.

Suggestions Competition—

(*Continued from page 397*)

THREE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: E. Smith, Rosemount, Montreal, Canada; L. M. Noguera, Buenos Aires; J. A. McMillan, Auckland; New Zealand (11). TWO PRIZES, each consisting of a 4-7 Manual; D. R. Edwards, Green Point, Cape Town; A. H. Godfrey, Nairobi, Kenya Colony (9). SEVEN PRIZES, each consisting of a Meccano Engineer's Pocket Book: S. Foreman, Preston, Ont., Canada; R. J. Ranikhetvala, Bombay, India; J. R. Combrino, Turin, Italy; Austen W. Smith, Dayton, Ohio, U.S.A.; D. Vesborton, Adelaide, S. Australia; J. Breitz, Hamburg; S. Coombs, Vancouver.

Special Prize, £1 - 1s., A. M. Johnston, Dunstable, for Suggestion No. 139.

Conquest of the Air—(*Continued from page 381*)

to that time by British experimenters that the actual fliers at the meeting were all French. The only Englishman who made a definite attempt to fly was Sir A. V. Roe, who on the following day accomplished some long jumps in a triplane named "*The Bull's Eye.*" The wings of this machine were covered with paper.

The first aviation meeting in this country at which British airmen carried out successful flights was held in June, 1910, at Wolverhampton, and was followed a month later by one at Bournemouth. The success of the Bournemouth meeting was marred by a fatal accident on the second day to the Hon. C. S. Rolls. A tail elevator that had been attached to his Wright aeroplane capsized during a flight, and the machine crashed to earth.

"A Model Railway with Unusual Features"

(*Continued from page 409*)

with lead in order both to make them run more steadily—especially engines with their cardboard wheels—and to enable them to endure the pull of the rest of the train on a curve when next to the engine. Hornby couplings are fixed to all engines and passenger vehicles to prevent buffers interlocking. The tiny circles in the plan near the terminus mark the positions of ground signals.

The construction of the plan should be quite clear, except, perhaps, the scissors-crossing outside the terminus. This is built of four ordinary points joined to a cross-over, which is considerably cut down to suit the width of the platform. The two points of the scissors-crossing on the number 2 platform line are separated by the length of one straight rail, while those on number 3 platform line are divided by one half and one quarter straight rails.

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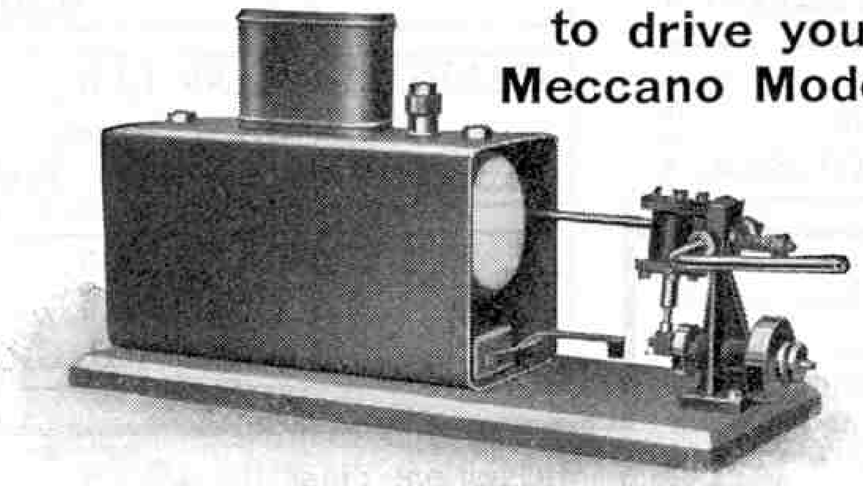

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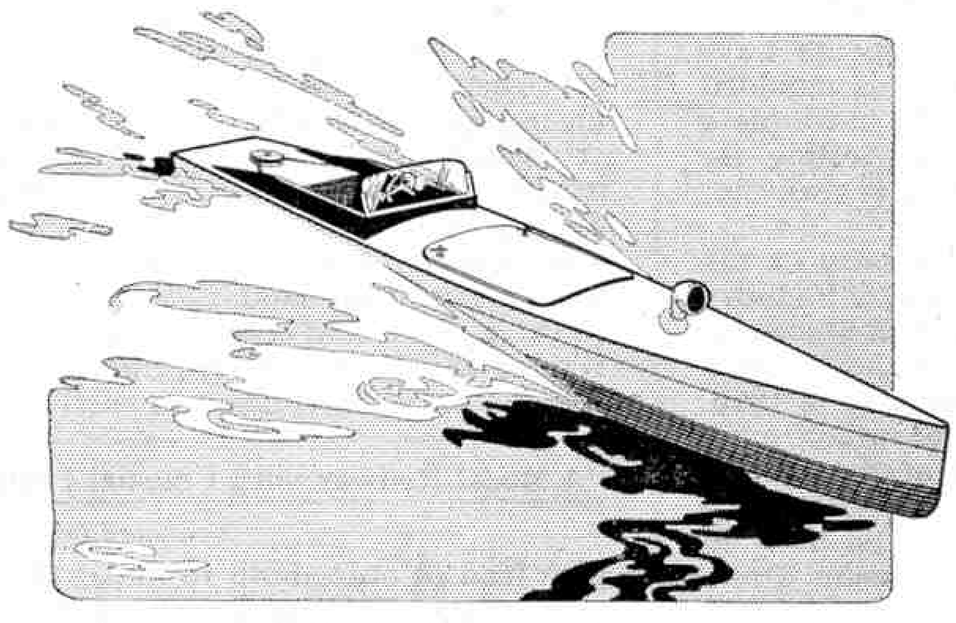

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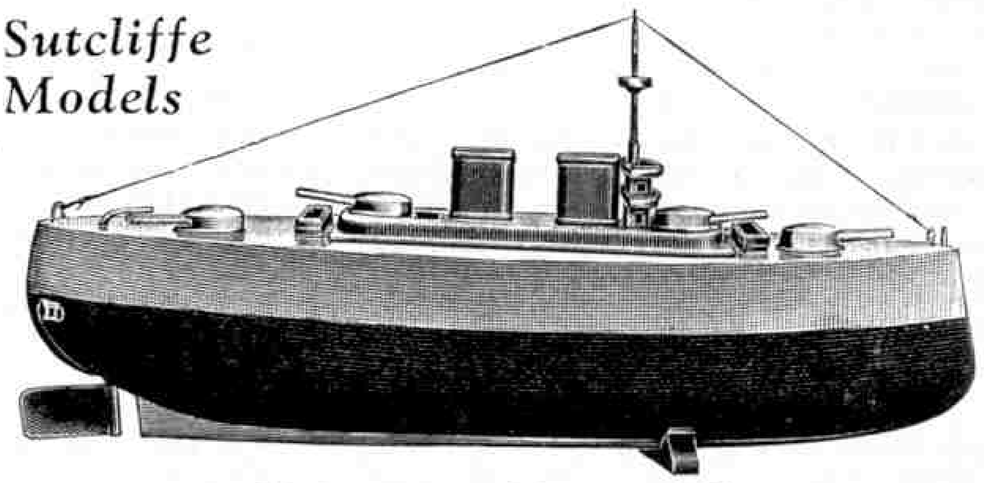

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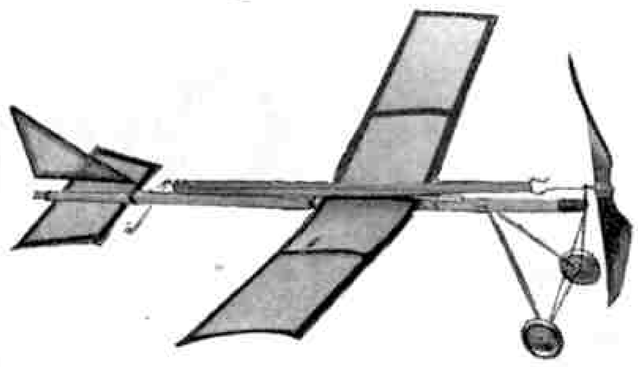

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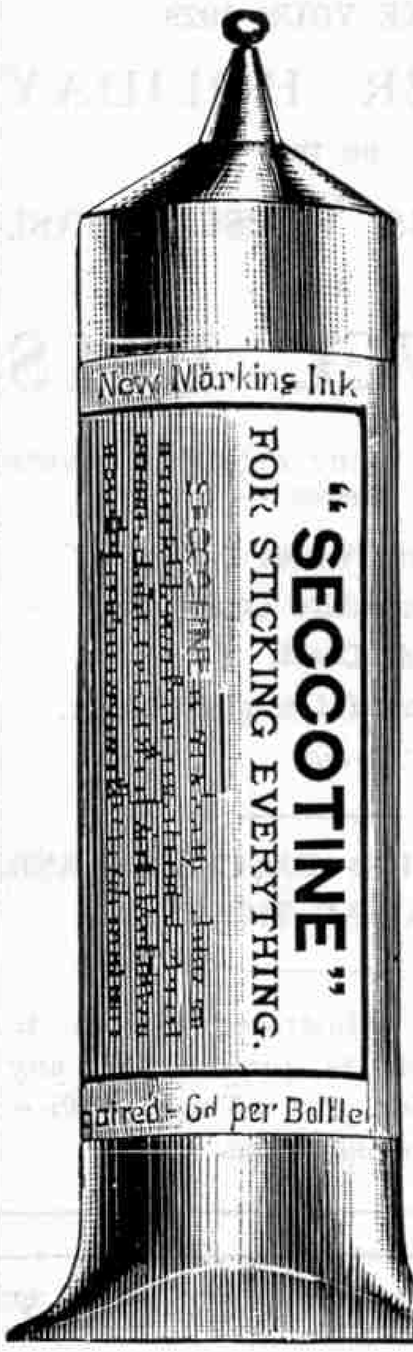

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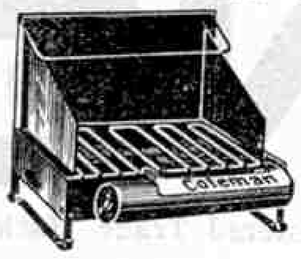

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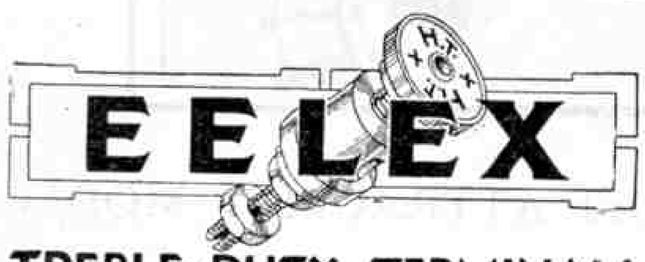

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Glorious West Coast

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The Clyde Coast.
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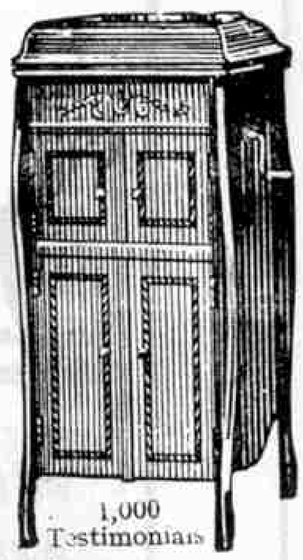

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A Fine Racing Yacht 13/6
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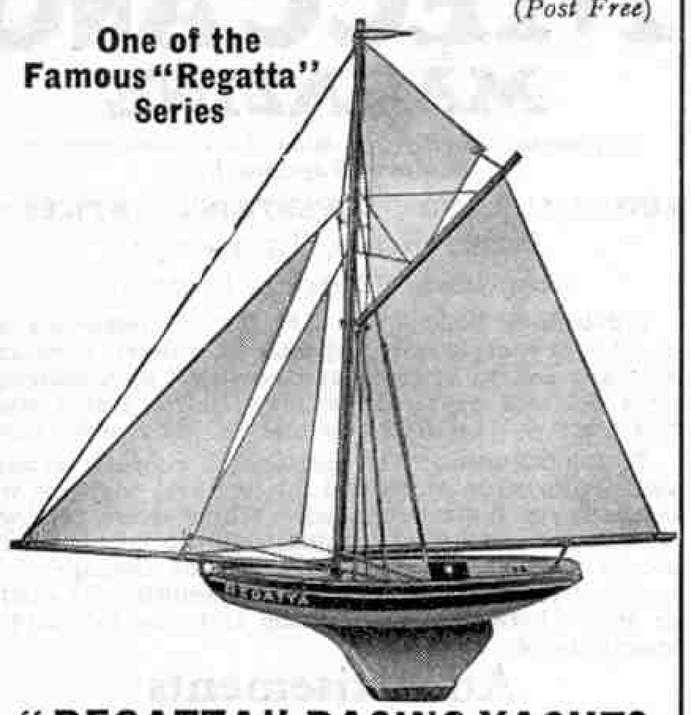
One of the Famous "Regatta" Series



"REGATTA" RACING YACHTS

This Yacht is 30" high with an 18" Deck and carries four white sewn sails which can be readily adjusted, like a real Yacht. There is a **Lead Keel** which makes for steady sailing. Mast and Rigging are removable for carrying. The Yacht is beautifully enamelled and lined in attractive colours; it is guaranteed to sail.

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SAFETY PISTOLS AND REVOLVERS

Can be bought, sold and carried without permit of any kind (except INDIA).

PISTOLS.

No. 54. Small Nickel Pistol with extractor and cartridge cover, solid barrel and top vent holes 1/11

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BLANK CARTRIDGES. 50, 9d.; 100, 1/3

Postage on Each 6d. extra.
Cartridges, Carriage 9d. per 100 miles.

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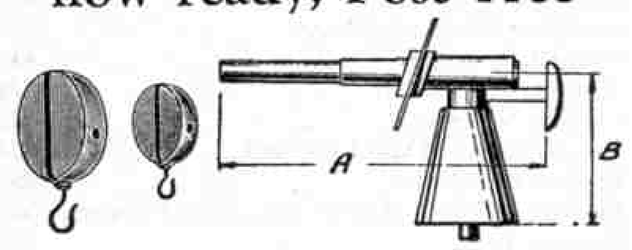
Our New List of Boat Fittings & Yachts is now ready, Post Free



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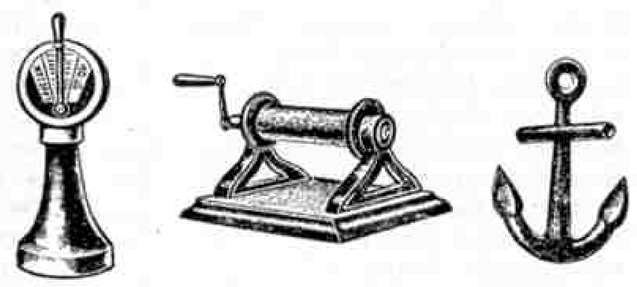

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Postage charged on goods under 2/- in value.

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COLOUR STENCIL-ART OUTFITS

An entirely new method of making Stencil Pictures for Post Cards and Wall Decoration—Special Felt and Wood Stumps—Artistic Dry Colours—Clean in Use.

You will be delighted with these fascinating Outfits:—

PRICE (Post Free) **2/9, 4/5, 8/-**

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LTD.,
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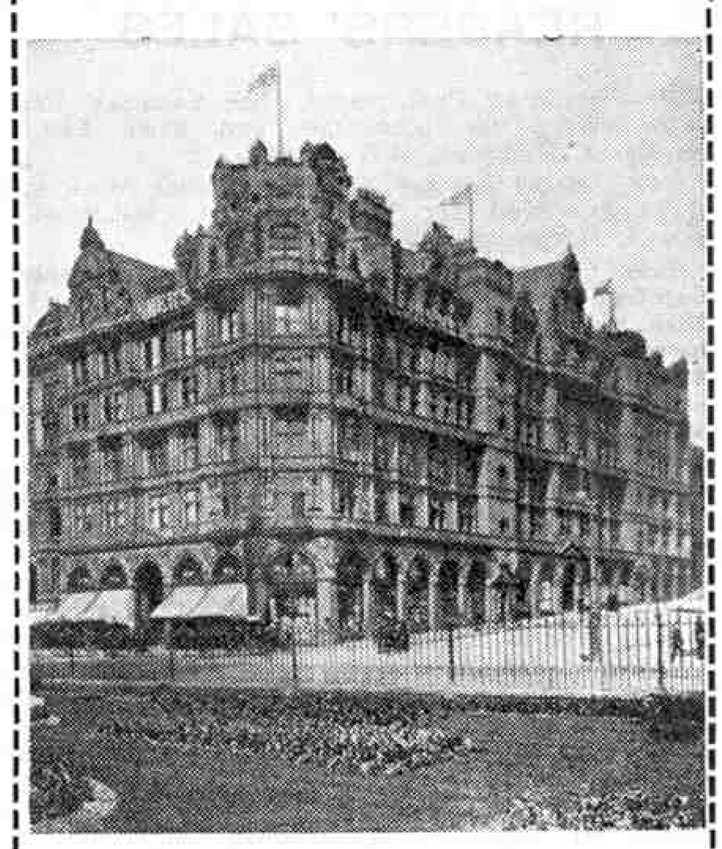

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EDINBURGH AGENTS for MECCANO and Hornby Trains

A complete stock of all Hornby Train Accessories and Meccano Parts

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"Mention Meccano."

ROLLER SKATES

"Wet or fine, rain or shine, Roller Skating all the time."

More Popular than Ever

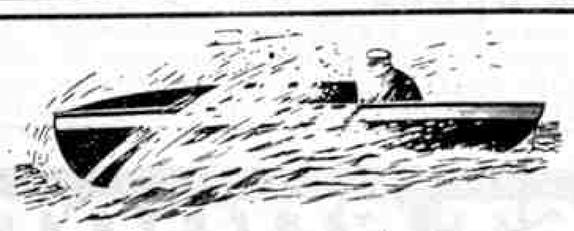
Our Skates are **suitable** for both **boys** and **girls**—are **certain to fit**—and—**THEY WILL BE APPRECIATED.**

No. 3 with Threaded Clamps and Case-hardened Steel Wheels ... 5/- pair
No. 5 with Best Ball-Bearing Wheels 10/- „
No. 6 with Best Ball-Bearing Wheels and Block Heels, as illustrated ... 11/- „

Postage and Packing 1/-, Colonies and Abroad 5/-

Bateson's Sports Depôt, Blackpool

"TOC-TOC" SPEED BOAT



INSTANT ACCELERATION

A NEW LARGE "TOC-TOC" IS NOW BEING PERFECTED, and will be ready for delivery in a week; length 15½ ins. **FAMOUS "TOC-TOC" SOUND DOUBLED IN VOLUME.** Price **12/6**; post free **13/3**. To become one of the first proud possessors of this wonderful super boat, **it is advisable to order of a dealer at once,** and perhaps leave a deposit to secure the purchase. The name of the Super **TOC-TOC** will be **TOC-TOC-FIFTEEN. HOT AIR DRIVE** from Meta, Spirit or Candle-end. No clockwork, battery or boiler. Nothing to explode! Runs 15/30 minutes without attention. Rudder.

CONTINUOUS "TOCK-TOCK" HEARD FOR GREAT DISTANCE

The *original* **TOC-TOC** (Toc-Toc-Nine) is still obtainable, of course, price **3/11** at shops, or **4/5** if supplied by post from—

ABBEY SPORTS CO. LTD. (Dept. M.C.), 125, Borough High Street, LONDON, S.E.1.
Wholesale Agents for Warneford Aeroplanes. Manufacturers of the guaranteed Class T Clockwork Boat.
Now turn up our SURESHOT advertisement on page 432.

Another "TOC-TOC"

COMPETITION — No Entrance Fee —

Three prizes value 30/- to be given away.

You must not miss this chance to win easily a valuable prize. All you have to do is to make up one or two short sentences, such as:—

"**TOC-TOC** is a fine Noise Maker"

utilising some or all of the letters in the following phrase:—

Toc-Toc Nine and Toc-Toc Fifteen are the only Speed Boats made to TOCK-TOCK.

"Toc-Toc" must appear in every sentence which you write. Competitors may send in as many attempts as they like, all on one sheet or separate.

READERS' SALES

Free Railroad Photographs. See Canada's Railroads. Write for particulars and Price List.—Levasseur, Hampton, N.B., Canada.

Sale. Model Railway, Gauge 0, Rolling Stock and Buildings. Send for list.—Evington, Hardenwick School, Harpenden.

Sale. Three Model Leeds Wagons, Four Passenger Coaches, Gauge 0 Signals, etc., 30/-. Fast Yacht, 23 in. deck, 21/-. Banjolele and Case, nearly new, bargain, 30/-, Cost 48/-. Pair Skates, 5/-.—"Highfield," Errwood Road, Levenshulme, Manchester.

No. 3 Shot Gun, 10/-. S.T. Plant, 7/6. Brownie No. 1 Camera, 6/-, or nearest. All excellent condition.—J. Timmis, Windmill, Hankelow, Nantwich.

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Sale. 79 "Scouts." Excellent condition. What offers?—S. Walker, "Emscote," Belwell Lane, Four Oaks, nr. Birmingham.

Sale. Many Meccano Magazines, Boys' Own Papers, and Boys' Papers, also "Bing" Engine. Stamp for List.—Coveney, Saxon Road, Hoylake, Cheshire.

Meccano Magazines 1925–1928, 4/- per year or offers.—Lord, Princes Road, Stamford.

Bound Volume 1928 "Scout," 1922-23, 1925-26, 1926-27 "Boys' Own Annuals." "Navy and Army," Volume 1. "Wonder Book of Railways." Good condition. Offers?—11, Pool Street, Crossens, Southport.

Collectors' Stamp Duplicates sent on approval.—V. Matthews, 4, Victoria Terrace, Honiton, Devon.

Lizards 6d. each, Slow-worms 1/- (Food Worms), Carriage 2d.—Heath, Eastcott, Coryton, Devon.

Exchange. Best make, Gauge 0, £4 Model Railway (or parts) for Adana Printing Machine or good Colonial Stamps. All collectors should join the "Garrett Stamp Exchange." No subscription. Particulars, Lists.—"Brithdir," Marlpit Lane, Coulsdon, Surrey.

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Sale. Bowman Loco and Tender, cost 35/-, will take 27/6. Used twice only.—T. Haran, Melmount, Strabane.

For Sale. Bassett-Lowke Locos and Rolling Stock. Gauge 0.—Apply W. Young, Ittington, Beech Avenue, Glasgow, S.1.

16 "M.M.'s," Aug. 1927–Dec. 1928 (excepting Jan. 1928). Perfect. Offers.—BM/LOPK.

Sale. No. 2 Brownie with Portrait Attachment, 1928 Model. Excellent condition. 10/-.—W. Woodforde, Ashwell, Baldock, Herts.

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Sale. Simplex Typewriter, cost 15/-, sell 8/- or nearest.—A. Gregory, 39, East St., Faversham.

Cigarette Cards, Sets, Odds, Lots. Lists.—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Sale. "Meccano Magazines," Oct. 1922–Dec. 1928. Excellent condition. 16/- or offers. Also Hawkeye Camera, 7/6.—261, St. Saviour's Road, Saltley, Birmingham.

"M.M.'s" for sale. Day, 63, Darnley Street, Manchester S.W.

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RAILWAY PHOTOGRAPHS

New May List Now Ready

Our railway photographs are the finest ever produced and cost 3d. each, or 2/6 a dozen.

Send 4d. for specimen card and latest list M5 (just published).

Railway Photographs, 23, Hanover St., Liverpool.

CINEMATOGRAPH FILMS, Machines, and Accessories at bargain prices. Illustrated lists post free.—Filmeries, 57, Lancaster Rd., Leytonstone, London, E.11

MAGIC X-RAY, 1/-, Post 2d. Free Gift with each.—Smethurst, 84, William Street, Heywood, Lancs.

Blushing, Self-Consciousness

Genuine cure. No exercises. Send only 1½d. stamp.
M. F. HUGHES, 7, Southampton Row (B167) London.

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These Writing Pads are just the thing to use when writing to your friends, for the special notepaper shows at once that you are a Meccano boy.

The pads are supplied in two sizes, each consisting of 50 printed sheets of tinted bank paper with cover. Prices—Large, 1/- each (post free); Small, 6d. each (post free), from Meccano Ltd., Old Swan, Liverpool.

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I cured myself. You can **cure yourself** (or a child) **quickly, permanently.** Particulars **free.**
M. F. HUGHES, 7, Southampton Row, London, W.C.1.

This Space is set to ½ inch s.c. and costs 8/- per month. The sum is the 50th of £20 the price of a whole page advertisement. Over 69,600 copies of the last issue were sold in various parts of the world. Your advertisement therefore reaches this exclusive public for approximately 1½d. per 1,000.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office. 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Advertisements

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/- per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/- per copy (postage extra), and the subscription rates 7/- for six months and 14/- for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post free).

The U.S.A. price is 15c. per copy, and the subscription rates 90c. and $1.75 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 45, Colborne Street, Toronto.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street. Bombay: Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

"MECCANO MAGAZINE" BINDERS

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines—price 4/6 post free. The small binder holds 6 Magazines—price 3/- post free. Meccano Ltd., Binns Road, Old Swan, Liverpool.

As BOYS Simply MUST SHOOT
Let the GUN be the "SURESHOT" Springless (Safety)

Astonishingly accurate over long range. Ideal for Indoor and Outdoor Sport. THE SPRING IS IN THE BULLET (extra bullets obtainable). Complete with Movable Target and Catch Net, **5/-**, of leading toy dealers, or **5/6** post paid from
ABBEY SPORTS CO. LTD., (Dept. M.C.), 125, Borough High Street, London, S.E.1. Now see our advertisement on page 431.

Manufacturers of the Guaranteed Class T Clockwork Boat. Wholesale Agents for Isle of Wight Yachts, Rudds Helioflyers, Warneford Aeroplanes

SURE SHOT SPRINGLESS GUN

A VERY FINE GUN

5/- COMPLETE

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The Boys' Own Store

Games, Sports Kit, Hobbies, Clothes—Gamages can supply everything that every boy wants. For 50 years this great Store has maintained a reputation for quality goods and economical prices which is second to none.

We stock all Hornby Trains and Meccano Parts and send them Carriage Paid to any Station U.K.

GAMAGES Summer Sports Catalogue

Write for free copy of GAMAGES SUMMER SPORTS CATALOGUE, a reliable guide to all Sports purchasing. Special terms to Clubs.

The "ETONIAN" TENNIS RACQUET

The "Etonian." A strong serviceable Racquet, strung plain white gut with double centre mains, hollow wedge, reinforced with ash and bound on each shoulder with silk and gut.

13/6

The Famous

Yorkshire Driver Cricket Bat

Youths' Model

Rubber and Cane Handles. Selected Blades.

No. 4	Price	**9/6**
No. 5	,,	**10/6**
No. 6	,,	**11/6**
Harrow	,,	**15/-**

Post 6d. and 9d.

LEG GUARDS

14 in.

Youths' strong White Canvas. Instep to Knee.

6/6 pair.

Boys' **5/11**

Post 6d.

Cricket Balls

Colonial type, **3/9** & **5/6**

Compo. Balls, **9d.** & **1/6**

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This is one of the oldest games—almost every boy or girl has played it at some time or another. Every youngster will appreciate a set complete with all the necessary bases, well-turned sticks and good ball. Sets containing Sticks and Regulation Ball, **3/6** and **4/11**. post 6d.

Rounder Bats, White Wood	1/3 each
With Half Cane Handle	3/11 ,,
Rounder Sticks	1/- ,,
Ditto Balls	10/6 doz.

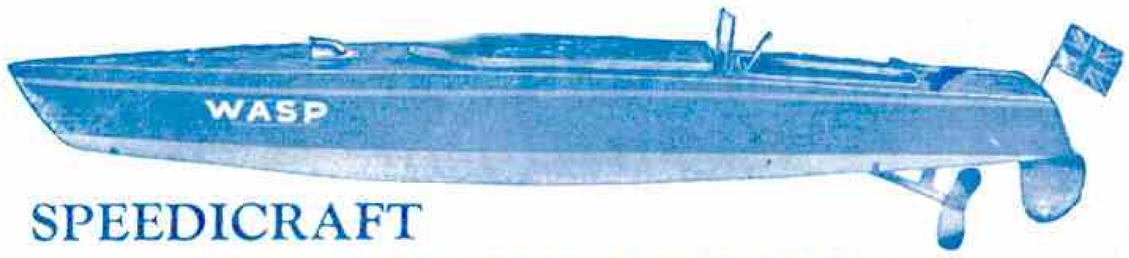
Post 9d.

THE FOX GUN

The Only Double-Barrelled Breech-Loading Toy Gun

The Fox Toy Gun is a real double-barelled breech-loading "Shot Gun." The cartridges are just replicas of real ones, except that instead of explosives a strong spring supplies the power of ejection. It is absolutely harmless but will shoot with sufficient force and accuracy for target practice. It is a certain delight to every boy. An attractive target is supplied with each gun, together with two cartridges and a quantity of extra balls, which, of course can be used over and over again.

17/6



SPEEDICRAFT

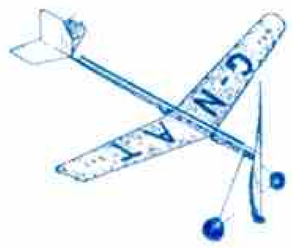
An entirely New Range of Racing Boats built of Mahogany.

CLOCKWORK MOTOR BOAT.—Smart Models built on the lines of Modern Motor Racing Boats. With exceptionally strong mechanism and constructed of the finest materials procurable. Fittings comprise ventilator, windscreen, steering gear, finished in the highest quality enamel, adjustable rudder, two-blade propeller. In three sizes, "THE GNAT," length 13½ in. **5/11**

"THE WASP," length 15½ in. **9/6.** "FIREFLY," length 17 in. **12/6**

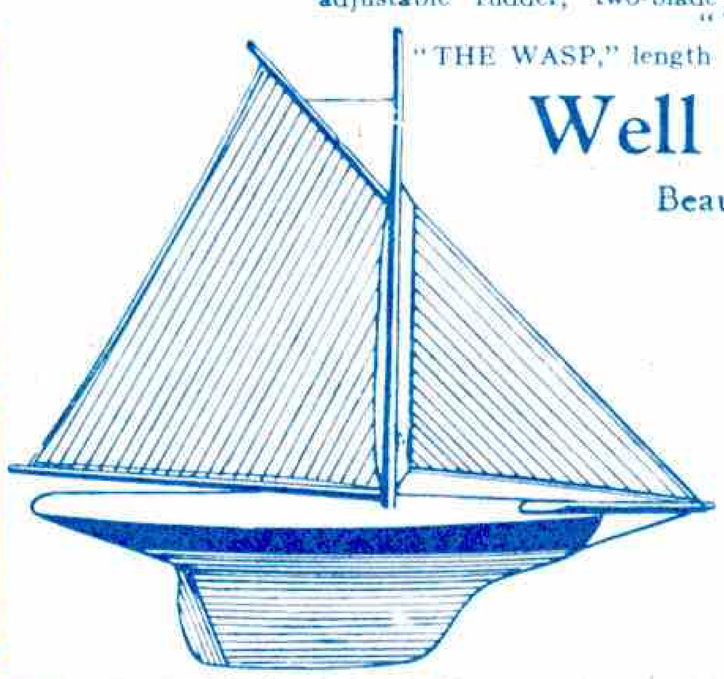
The Latest Model Aeroplane
The "GNAT" Flier

Price **1/9** Post Free U.K.



Price **1/9** Post Free U.K.

Tractor All Wood Monoplane fitted with Wheels.
All ready to fly. Guaranteed to fly.
Packed in Cardboard Box with full instructions.



Well Finished CUTTER

Beautifully Painted and Varnished.
Imitation Plank Deck.
Similar to illustration.
Hollow.

12 ins.	14 ins.	16 ins.
4/11	**7/3**	**10/6**

18 ins.	21 ins.
14/-	**18/6**

Post 6d.

GAMAGES, HOLBORN, LONDON, E.C.1. City Branch: 107, CHEAPSIDE, E.C.2

All the latest Meccano achievements

New Speed Governing Appliances
New Cranes — New Valve Gears
New Locomotives — New Movements
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